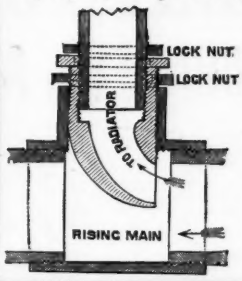
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIX. No. 1763.] LONDON, FEBRUARY 23, 1897. [49TH YEAR. PRICE 6d.

TUBES AND FITTINGS
FOR
GAS, STEAM, WATER,
AND ALL PURPOSES,
ALSO
COILS OF EVERY SIZE AND SHAPE.

Apply to the Original Firm of
JOHN BROTHERTON
LIMITED,
Imperial Tube Works, Monmore Green,
WOLVERHAMPTON.
ESTABLISHED 1861.

GAS CONSUMERS' REQUIREMENTS.
TUBES, COCKS, UNIONS, BRACKETS, PENDANTS, LANTERNS, CHANDELIERS, AND GENERAL FITTINGS.
MANUFACTURED BY
VAUGHAN & BROWN, LTD.,
15, 16, 17, Kirby Street, London, E.C.



SPECIALITE
FOR
HOT-WATER CIRCULATION,
THE
"ACME"
PATENT
INJECTOR,
to be fixed in connection with Radiators on Mains.

— ESTABLISHED 1830. —
PARKER & LESTER,
Manufacturers & Contractors.
THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores, for Gas and Water Works.
WORKS:
ORMSIDE STREET, OLD KENT ROAD,
LONDON.

'BEAR CREEK' CANNEL
LOG MOUNTAIN COAL, COKE, AND TIMBER CO.
PINEVILLE, KENTUCKY, U.S.A.
Cable Address:
"HULL, PINEVILLE." Codes used "ABC" & "A1."
Communications to the Company only.

CARLESS, CAPEL & LEONARD,
HOPE CHEMICAL WORKS, HACKNEY WICK, LONDON, N.E.,
And at Pharos Works, Hackney Wick.
NAPHTHA AND GASOLINE DISTILLERS AND PETROLEUM IMPORTERS,
Specially distil Carburine Spirit, specific gravity ·680, or of any other grade suitable for Enriching Gas; also Gas Oil best adapted for injecting into the Retorts, as in the Herring Process.
Importers of Petroleum for Carburetting Water Gas, or for Manufacturing Oil Gas. Distillers of Pentane, Petroleum Ether, and Naphtha for clearing the pipes of Naphthaline, &c.
Samples and Prices may be had on application.

4,444
"MELDRUM" FURNACES
MADE TO DECEMBER 16th, 1896.
No Gas-Works should be without. WRITE FOR CATALOGUE & TESTIMONIALS.
MELDRUM BROS., ATLANTIC WORKS, **MANCHESTER,**
Also at London, Leeds, Birmingham, Liverpool, Newcastle, and Glasgow.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765).

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

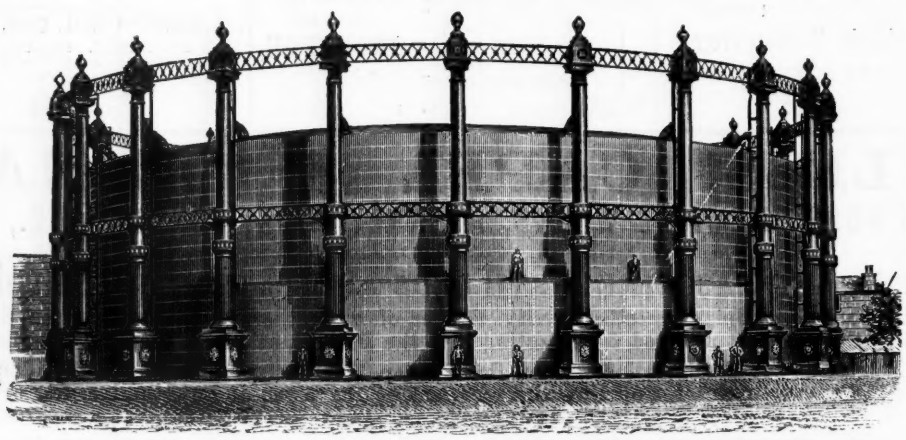
TELEGRAPHIC ADDRESS: "COCKEY'S FROME."

EDWARD COCKEY & SONS, Ld.,

ESTABLISHED OVER HALF A CENTURY.

GAS ENGINEERS, IRONFOUNDERS, & CONTRACTORS,

Manufacturers of GASHOLDERS and TANKS, BOILERS and ENGINES, ROOFS, EXHAUSTERS, BREEZE SCREENS, CHARGING and COKE BARROWS.



Manufacturers of PATENT WASHERS, PATENT VALVES for PURIFIERS, &c., GOVERNORS, LAMP COLUMNS, Weighbridges, COKE BREAKERS.

MAKERS OF FISH & SMITH'S PATENT (NO. 5108) OVERFLOWS FOR REGULATING THE SEAL IN GAS-WASHERS, &c., AND COCKEY & SMITH'S PATENT SELF-ACTING BYE-PASS VALVES.

Estimates for any description of Gas Plant on application.

THE IRON-WORKS, FROME SELWOOD, SOMERSET.

London Office: BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C. *BALE AND HARDY, Agents.*

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

—11 MEDALS.—

MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

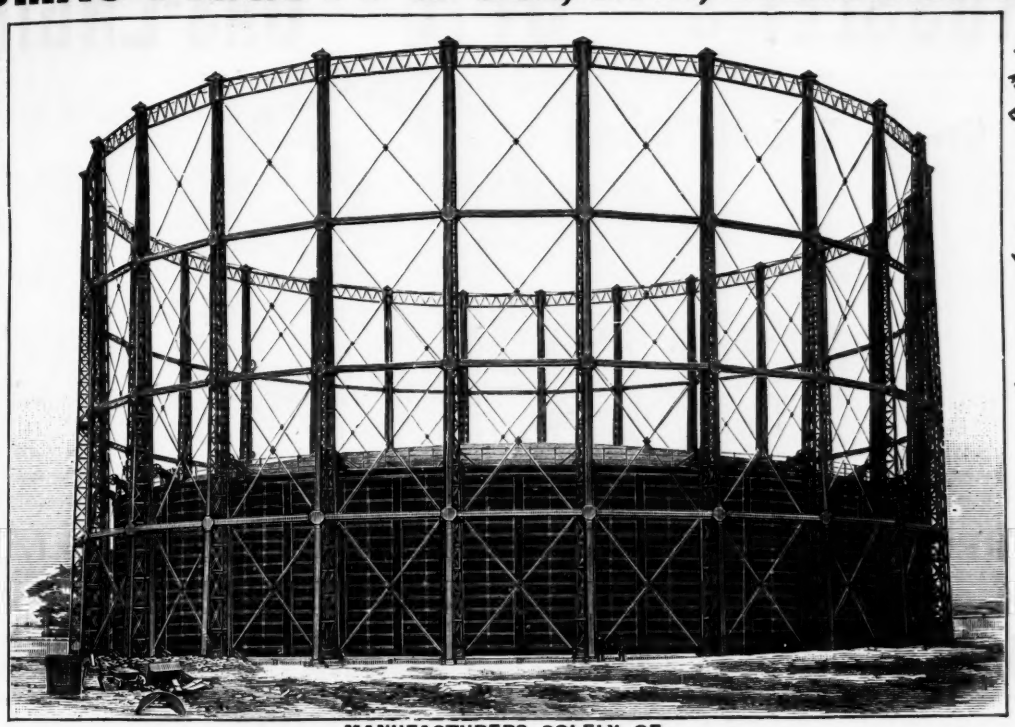
SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

LONDON: 103, Southwark Street. MANCHESTER: 33, King Street West. BIRMINGHAM: 114, Colmore Row. LEEDS: 6, Mark Lane, New Briggate.

THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT. FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS BIRMINGHAM

WELDED & RIVETED PIPES, FOUL MAINS, RETORT. LIDS, WROT & CAST TANKS, PURIFIERS.

MANUFACTURERS SOLELY OF

HUMPHREYS & GLASGOW'S

PATENT CARBURETTED WATER-GAS PLANT.

INSTALLATIONS have already been supplied, and are in operation at the following Gas-Works: COPENHAGEN, BELFAST, GLASGOW, BRUSSELS, SANTIAGO, SWANSEA, TOTTENHAM, LIVERPOOL, BRIGHTON, BATH, PRESTON, SOUTHPORT, NEW YORK, NEWBURGH (N.Y.), NEWBURGH (Second Contract), HOYLAKE; and are in course of erection at: BELFAST (Second Contract), EDINBURGH, TOTTENHAM, WINCHESTER, MANCHESTER, BRUSSELS (Second Contract), ST. JOSEPH (MO.), HOLYOKE (MASS.), SHANGHAI, STOCKTON, STOCKPORT, NORWICH, GUILDFORD, SYRACUSE, BORDENTOWN, LEA BRIDGE, COVENTRY.

All Particulars from Patentees: 9, VICTORIA STREET, LONDON, S.W.

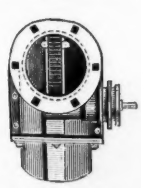
NEWTON, CHAMBERS, & CO., LIMITED,

THORNCLIFFE IRON-WORKS, near SHEFFIELD,

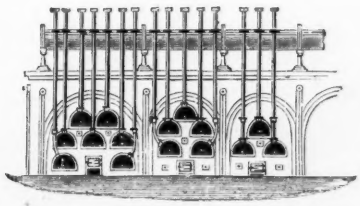
MANUFACTURERS OF

SLIDE VALVES,
WITH RACK & PINION
OR
Internal or External
SCREWS of all sizes.

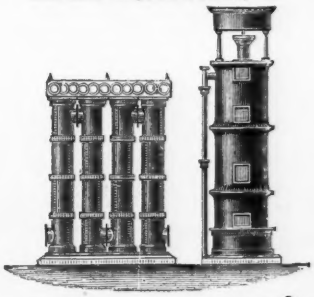
GASHOLDERS,
AND
Gasholder Tanks.



CAST-IRON RETORTS,
RETORT-BED FITTINGS,
And Retort-House Appliances
of every description,
Iron Roofs, Columns, Girders, Floor Plates,
Tools, &c.

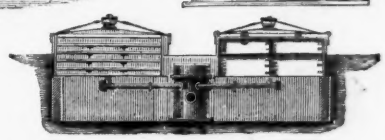


WROUGHT AND CAST IRON
CONDENSERS, SCRUBBERS, & WASHERS,
TAR AND LIQUOR PUMPS, &c.



PATENT
CENTRE-VALVES
for working Purifiers,
Also Bye-Pass & Stop Valves

PURIFIERS with Planed Joints,
HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS, and SPECIALS.
WOOD GRIDS.
CAST AND WROUGHT IRON TANKS AND CISTERNS.



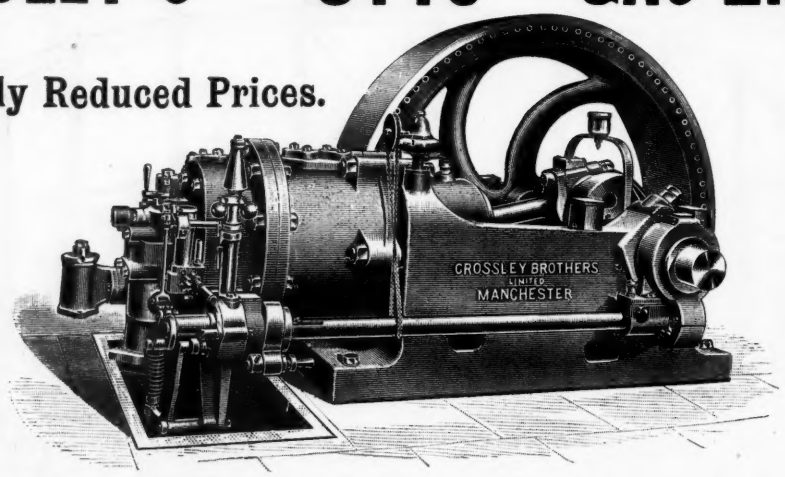
DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

CROSSLEY'S "OTTO" GAS-ENGINES

Greatly Reduced Prices.



REPRESENTS NEW TYPE 40-HORSE POWER NOMINAL HIGH-SPEED ELECTRIC-LIGHT ENGINE.

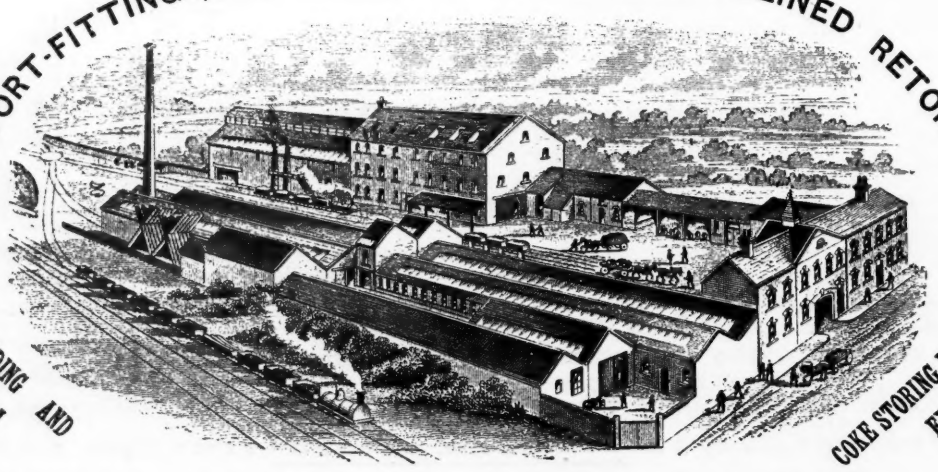
CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER.

HARRIS & PEARSON,
STOURBRIDGE, ENGLAND
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

W. J. JENKINS & CO.

GAS ENGINEERS AND IRONFOUNDERS,
MAKERS OF ALL KINDS OF
PLANT AND MACHINERY FOR GAS-WORKS.
COAL-BREAKERS. COKE-SCREENS.
MOUTHPIECES. LIQUOR-TANKS.

RETORT-FITTINGS, REGENERATOR SETTINGS, INCLINED RETORTS.



COAL UNLOADING AND CONVEYING A SPECIALITY.

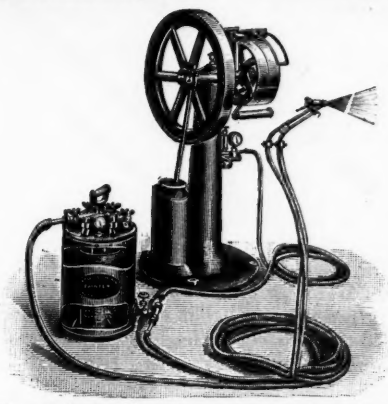
COKE STORING PLANT, ENGINES, EXHAUSTERS, VALVES.

BEEHIVE WORKS, **RETFORD,** NOTTS.

WELLS' LIGHTNING PAINTER

PAINTING BY MACHINERY. GREAT SAVING IN TIME AND LABOUR.

INVALUABLE FOR PAINTING GASHOLDERS, GIRDER WORK, &c.



No. 1 Painting Machine, attached to a Single Air-Compressor, driven by Belt Power. Can be arranged with Handle for Man Power.

No. 1 Painter	£20	0	0
No. 2 „	25	0	0
Single Air-Compressor	16	10	0
Double „ „	25	0	0

No. 2 Painter may be arranged with Two Sets of Nozzles, Hose, &c., for Two Men to Work from one Machine, £8 extra.

Speed 3 Square Yards per Minute.

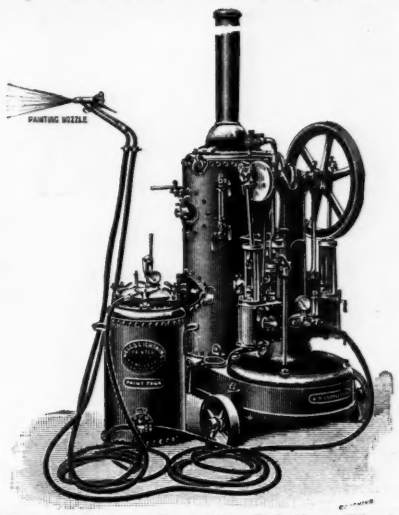
FOR

GAS ENGINEERS,
CONTRACTORS,
GIRDER YARDS,
BRIDGE BUILDERS,
BOILER SHOPS,
&c., &c.

AS SUPPLIED TO THE

GLASGOW,
NOTTINGHAM,
and OLDHAM
CORPORATION
GAS-WORKS.

Send for Illustrated Price Lists.



Special Steam Portable Painting Plant Complete, for working round Large Surfaces such as Gasholders, &c.

Price: Engine and Air-Compressor, with Boiler on Wheel Base, £90.
No. 2 Painter . . . . . £25.

A. C. WELLS & CO., MIDLAND ROAD, ST. PANCRAS, LONDON. BRANCH: CARNARVON ST., MANCHESTER.

JAMES MILNE & SON, LTD.,

MILTON HOUSE WORKS, EDINBURGH.

60, HOLBORN VIADUCT, LONDON. | 111, ST. VINCENT STREET, GLASGOW. | 48, WELLINGTON STREET, LEEDS.

CONSUMERS' WET AND DRY GAS-METERS.

PREPAYMENT WET AND DRY GAS-METERS.

STATION GOVERNORS.

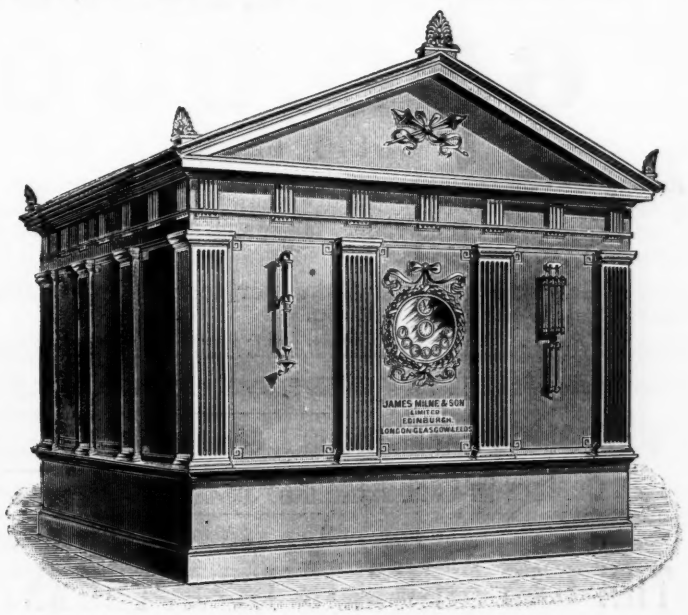
PRESSURE-REDUCERS.

ENGINES & EXHAUSTERS.

VALVES.

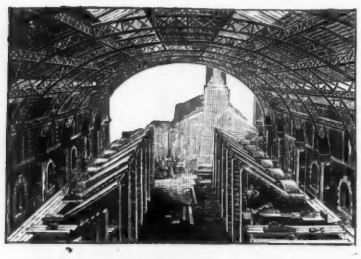
PRESSURE GAUGES.

MAIN COCKS.



W. C. HOLMES & CO.

IRONFOUNDERS AND CONTRACTORS.

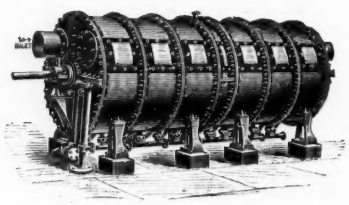


Makers of
GAS & CHEMICAL
PLANT.

Telegrams:
"HOLMES, HUDDERSFIELD."

Improved
PATENT SCRUBBER-WASHERS,
All sizes,
From 50,000 to 5,000,000 Cubic Feet of Gas per day.
Results unrivalled. Send for Particulars and Prices.

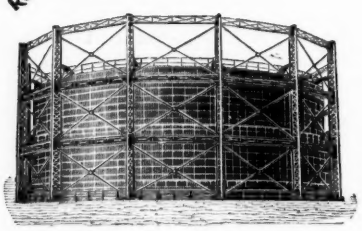
MALLEABLE
and all Kinds of
CASTINGS.



GASHOLDERS of Improved Construction and of all Sizes.
ROOFS, BRIDGES, TANKS, GIRDERS.

Improved
BYE-PASS and
CENTRE-VALVES,
GOVERNORS,
and METERS.

Rotary or Pump
EXHAUSTERS.



80, CANNON STREET, LONDON,
AND
WHITESTONE IRON WORKS, HUDDERSFIELD.

THE
MAXIM PATENT CARBURETTOR
FOR ENRICHING GAS IN BULK.
Over 50 Maxim Patent Carburettors have now been fixed, capable of enriching
650,000,000
CUBIC FEET OF GAS PER DAY.

Among the Companies supplied are The Gaslight and Coke Company, the South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **FOUR YEARS.**

More Gas and saleable Coke per ton of Coal Carbonized is produced; saving Capital, Labour, Fuel, Wear and Tear, &c.

The Enrichment is **INSTANTANEOUS** and **PERMANENT.**

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

Dealers in Carburine and all other Naphthas for the Enrichment of Gas.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,
18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

INCANDESCENT GAS-LIGHT

(WELSBACH PATENTS).

THE GREATLY REDUCED CONSUMPTION OF GAS

Covers the Initial Cost of the Burner in less than SIX Months.

The Prices have been REDUCED as follows:—

The Ordinary "C" Burner, price 6/6

The "C" Bye-Pass Burner, „ 7/6

Prices of other Patterns Reduced Proportionately.

Special attention is called to

The New "Gem" Burner, price 5/6

which, with a consumption of $1\frac{3}{4}$ cubic feet of gas an hour, gives

A LIGHT OF 30 TO 35 CANDLE POWER.

This pattern is particularly suited for Domestic Lighting, and is specially recommended where it is desired to effect a large saving in gas rather than to effect a great increase in the light.

The attention of Gas Managers and Gas Engineers is called to this System of Lighting as one which tends to Popularize the Use of Gas as an Illuminant, owing to the following Advantages:—

Economy in Consumption of Gas, combined with High Illuminating Efficiency.

Freedom from Smoke, Dirt, and Flickering.

Greatly Reduced Heat.

The combination of High Lighting Power with DURABILITY can only be obtained by The Welsbach System.

The "Lancet" Special Analytical and Sanitary Commission, in an exhaustive report, pronounces the "Incandescent Gas-Light System" to be the Healthiest, Best, and most Economical System of Gas Lighting.

Suitable for every purpose of Inside and Outside Lighting.

Avoid the WORTHLESS IMITATIONS now being offered by UNSCRUPULOUS INFRINGERS.

OVER ONE HUNDRED AND FIFTY JUDGMENTS

and Interim Injunctions recently obtained against Companies, Firms, and Persons INFRINGING THE "WELSBACH" PATENTS, or INFRINGING THE LIMITED LICENSE under which the Mantles are sold.

FOR FURTHER PARTICULARS, APPLY TO

THE INCANDESCENT GAS-LIGHT COMPANY, Ltd.

PALMER STREET, WESTMINSTER, LONDON, S.W.

WILLEY & CO., GAS ENGINEERS,

CONTRACTORS TO THE GOVERNMENT,

LONDON & EXETER.

Offices: HAVEN ROAD, ST. THOMAS, EXETER.

Engineering Works & Brass Foundries: ST. THOMAS, EXETER.

Meter Factories & Works: JAMES STREET, EXETER; and 248, KINGSLAND ROAD, LONDON.

LATEST SPECIALITIES.

WATER-GAS APPARATUS—A Model Plant in course of erection at their Exeter Engineering Works. Continuous Process; the best Results yet attainable.

COLUMNLESS GASHOLDERS—Makers of Gadd & Mason's Patent System.

Agents for the **MAXIM CARBURETTOR.**

GAS ENRICHMENT in bulk or on Outlet Main.

Makers of the **LIVESEY WASHER.**

Manufacturers of **WET AND DRY GAS-METERS.**

Their Patent **PENNY-IN-THE-SLOT AUTOMATIC METER,** admittedly one of the most perfect in the Market. Thousands in use in London and the Provinces.

Manufacturers of **GAS-FITTINGS** in endless variety—**CHANDELIERS, BRACKETS, PENDANTS, MAIN COCKS, &c., &c., &c.** **SPECIAL FITTINGS** for the Automatic Business.

Metropolitan Agent;

FRANK ACLAND, M.Inst.C.E., M.Inst.M.E., 76, Cheapside, E.C.

Telegraphic Address: "WILLEY, EXETER." Telephone 132. Established over 30 Years.

THE NEW INCANDESCENT (SUNLIGHT PATENT) GAS LIGHTING COMPANY, LIMITED.

THE SUNLIGHT COMPANY having finally beaten the Welsbach Company in the Law Courts, notwithstanding the misleading statements which are being advertised, the Legal Position of its Mantle is now

ESTABLISHED BEYOND ALL QUESTION.

Mr. JUSTICE WILLS says in his Judgment: "No use is made by the Defendants (the Sunlight Company) of any of the rare earths; and their choice of substances, and their method of applying the illuminants, appear to me to be as wide asunder as the poles from those contemplated by Welsbach."

Therefore any interference with our Customers by the Incandescent Company in the use of our Mantles, either on our Burners *or on theirs*, should be promptly reported. **It will at once be summarily dealt with by us, without cost to our Customers.**

THE SUNLIGHT MANTLE gives a

SOFT MELLOW LIGHT, VERY

AGREEABLE TO THE EYESIGHT, AND HEIGHTENS THE

DECORATIVE EFFECT OF PLEASANT COLOURS.

WE ARE PREPARED TO *MAINTAIN ALL BURNERS* FITTED BY OURSELVES AT A VERY LOW PRICE PER ANNUM;

AND *SPECIAL TERMS* FOR *RENEWAL MANTLES* WILL ALSO BE MADE TO THOSE WHO PREFER TO DO SO THEMSELVES.

THE NEW INCANDESCENT (SUNLIGHT PATENT) GAS LIGHTING COMPANY, LIMITED,

33 & 34, SHOE LANE, LONDON, E.C.

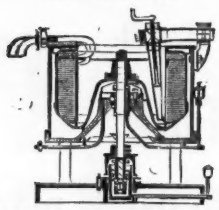
KIRKHAM, HULETT, & CHANDLER, LD.

3 & 4, PALACE CHAMBERS, BRIDGE STREET, WESTMINSTER, S.W.

MARSHALL'S PATENT COMBINED BATTERY CONDENSER AND SCRUBBER.

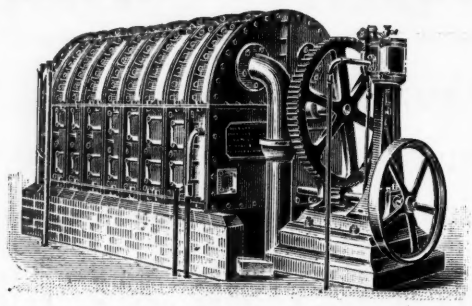
Extract from letter from Mr. Winstanley, of Coventry: 'The Condensers you erected for us have been in use some time, and are working very satisfactorily.'

BURMEISTER AND WAIN'S TAR-SEPARATOR.



EXTRACTS OVER 99 PER CENT. OF AMMONIACAL LIQUOR FROM TAR.

PATENT "STANDARD" WASHER-SCRUBBER.

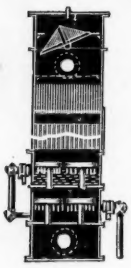


OVER **530** *MACHINES*

In use and in course of Construction.

They extract all the Ammonia and a large proportion of Carbonic Acid and Sulphuretted Hydrogen.

PATENT "STANDARD" VERTICAL SCRUBBER AND TAR-EXTRACTOR.



SUITABLE FOR SMALL WORKS WITHOUT AVAILABLE MOTIVE POWER FOR MECHANICAL WASHERS.

MARSHALL'S PATENT TAR EXTRACTOR AND WASHER.

Extract from letter from the Late Mr. Jabez Church: "The Marshall Patent Tar-Extractor has given very satisfactory results."

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

Midland District Office: PRINCE'S CHAMBERS, 6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.

TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.

London District Office: 6, STRAND, LONDON—C. PARKER & SON, Sole Agents.

TELEGRAPHIC ADDRESS: "PARKER LONDON."

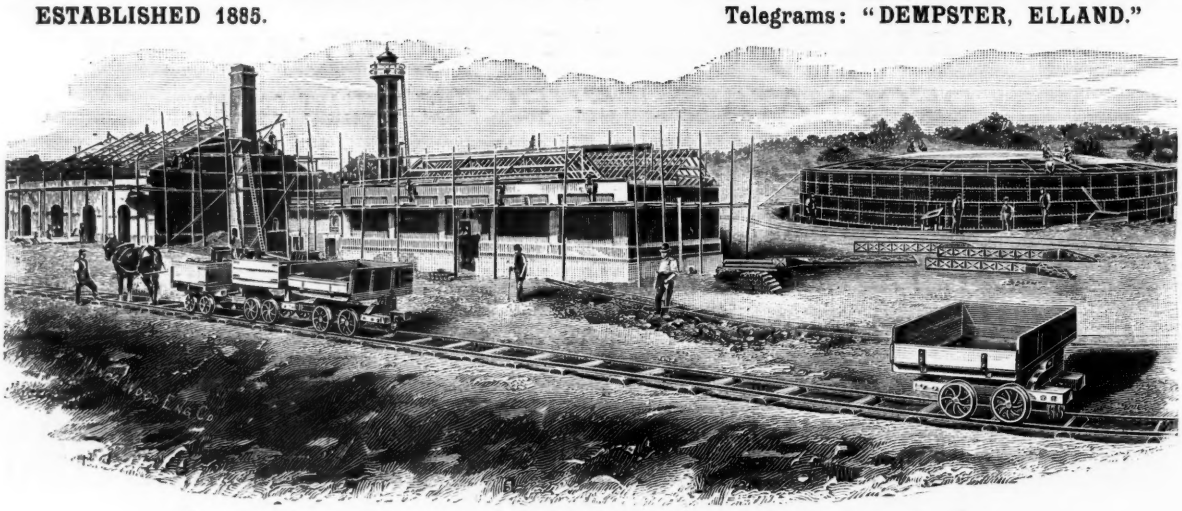
R. DEMPSTER & SONS,

LIMITED,

GAS ENGINEERS and CONTRACTORS,

ELLAND, YORKS.

ESTABLISHED 1885. Telegrams: "DEMPSTER, ELLAND."



Engraved from Photograph of Complete Gas-Works in course of Construction.

The WHOLE of the Apparatus, Foundations, Retort Work, Buildings, and Levelling of Site have been executed by our own Workmen. No Sub-Contracts.

Estimates and Illustrations for complete Works, or for any detailed parts, supplied gratis on application.
Tenders given for all kinds of Structural Ironwork.

GIBBONS BROTHERS, LIMITED,

Telegraphic Address: "GIBBONS, DUDLEY."

DUDLEY,

Telephone No. 8013.

GAS ENGINEERS, CONTRACTORS, RETORT SETTERS.

Patent REGENERATIVE SETTINGS,

GIBBONS & MASTERS' PATENT No. 1269, 1893.

SUITABLE FOR WORKS OF EVERY CAPACITY,

AND A SPECIAL FORM OF WHICH IS APPLICABLE TO

GASEOUS FIRING WITH A MINIMUM EXCAVATION.

RETORT-BENCH IRONWORK, CONDENSERS,

SCRUBBERS, PURIFIERS, VALVES, &c.

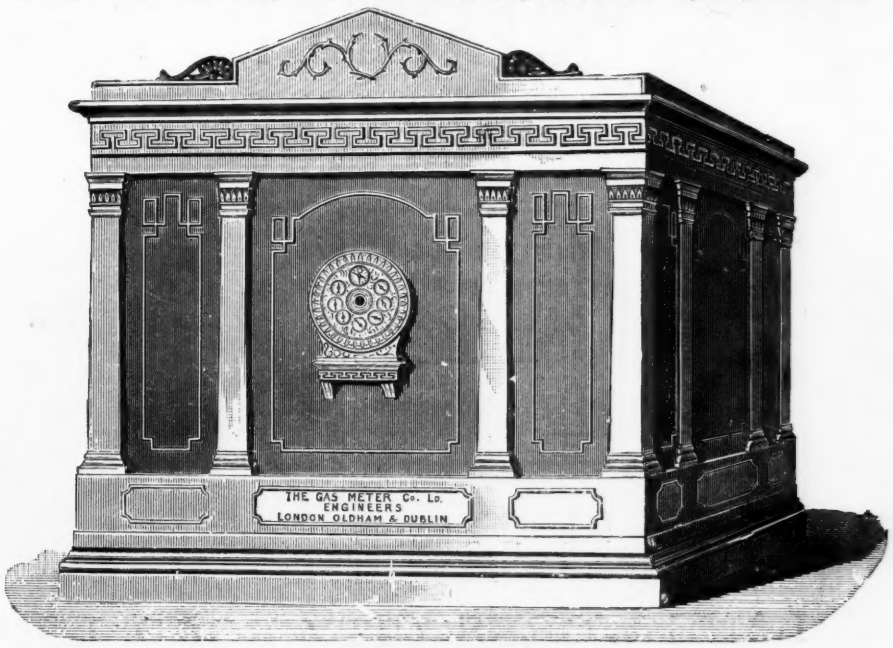
DESIGNS AND ESTIMATES ON APPLICATION.

THE GAS-METER COMPANY, LIMITED

MANUFACTURERS OF

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.



STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM, LATE WEST & GREGSON. Established 1830.

For Prices and Particulars apply to

R. L. ANDREWS, General Manager.

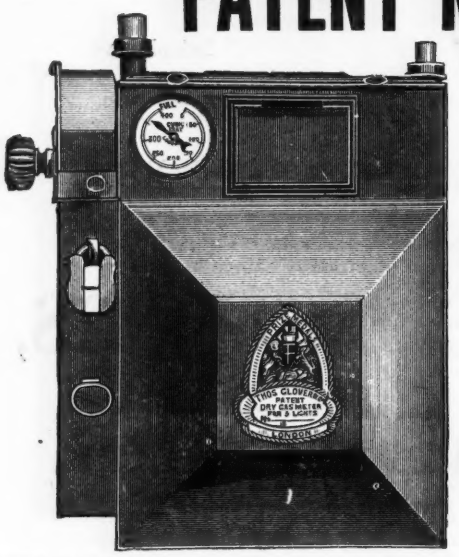
Works: 238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

Telegraphic Address: "METER."

(See Advertisement on back of Wrapper.

THOMAS GLOVER & CO.'S

PATENT NEW IMPROVED PREPAYMENT METER



For Pennies, Shillings, or any Coin.

Simple in Mechanism.
Positive in Results.
Price Changer *in Situ.*

GUARANTEED FOR FIVE YEARS.

Telegraphic Address: "GOTHIC LONDON." Telephone No. 6725.

THOMAS GLOVER & CO., LTD.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

BRISTOL:	BIRMINGHAM:	MANCHESTER:
62, VICTORIA STREET.	1, OOZELLS STREET.	37, BLACKFRIARS STREET.
Telegraphic Address: "GOTHIC."	*Telegraphic Address: "GOTHIC."*	*Telegraphic Address: "GOTHIC."*

PARKINSON'S

PREPAYMENT GAS-METERS

Many thousands in use in all parts of the Country.

COMBINE
SIMPLICITY with STRENGTH, and ACCURACY with COMPACTNESS.

COTTAGE LANE WORKS, CITY ROAD, LONDON.
BELL BARN ROAD WORKS, BIRMINGHAM.

Telegraphic Addresses { "INDEX, LONDON." / "GAS-METERS, BIRMINGHAM." }

Telephone Numbers (National) { London 7778. / Birmingham 1101. }

[See also Advt. p. 444.

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE

The South Metropolitan Meetings 397
The Affairs of the Liverpool Gas Company 398
Railway Rates for Coal in Bulk 398
The Second Reading of the Engines and Boilers Bill 398
The Chemist in the Future 399
The End of the Hamburg Strike. 399

WATER AND SANITARY AFFAIRS—

Postponement of the Second Reading of the London Water-Works Purchase Bills 399
A Bill to Amalgamate the Metropolitan Water Companies. . . 399

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market 400
Electric Lighting Memoranda. 400
The Secret of Progress. 401

NOTES:—

The Effects of Smoky Atmosphere 402
Superheated Steam 402
The Effect of an Atmosphere Surrounding an Electric Arc. . . 403
Photography in Natural Colours. 403
The Most Expensive Manufacturing Product. 403

COMMUNICATED ARTICLE:—

Stoppages in Ascension-Pipes. By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S. 403

TECHNICAL RECORD:—

The Denayrouze Burner in England 405
The Development of Light from Gas-Flames. By Professor Vivian B. Lewes, F.I.C., F.C.S.. 406
The Decomposition of Hydrocarbons by Heat 409
British Association of Water-Works Engineers—Annual Meeting in London—Mr. W. Watts, M.Inst.M. and M.E., F.G.S., &c., on Drainage Areas, Storage Capacity, and Compensation Water Discharged from Catchment Reservoirs 410
The Water Supply of Small Towns and Rural Districts. . . . 414

REGISTER OF PATENTS:—

Prepayment Gas-Meters—Sutherland, J. G. 415
Dry Gas-Meters—Hughes, T.. 416
Testing-Machines for Gas-Meters—Chollar, B. E. 416
Governors for Gas-Engines—Caldwell, R. 416
Manufacture of Fluid for Impregnating Fabrics, Threads, Fibres, or the like, for Illuminating or Lighting Purposes—Puchmüller, B. 416
Patent Notices 416

CORRESPONDENCE:—

The Use of Inclined Retorts 417
The Use of Sulphate of Ammonia with Lime in Agriculture . . 417
The Relation between Water Supply and Enteric Fever . . . 417

PARLIAMENTARY INTELLIGENCE:—

Progress of Bills; The Storage of Carbide of Calcium 418

LEGAL INTELLIGENCE:—

High Court of Justice—Chancery Division—

The Incandescent Gas-Light Company, Limited, *v.* Boehm . . 418
In re the Incandescent Gas-Light Company's Patents. . . . 419
Wholesale Waste of Water at Salisbury 419

MISCELLANEOUS:—

Meeting of the South Metropolitan Gas Company 419
Meeting of the Crystal Palace District Gas Company 421
Meeting of the Liverpool United Gaslight Company 422
Meeting of the Bristol Gas Company 423
Tottenham and Edmonton Gas Company—The Half-Yearly Report and Accounts. 423
Croydon Commercial Gas Company—The Hundredth Half-Yearly Report. 423
The Winding Up of the Chesterfield Water and Gas Company—A Final Dividend Declared 423
Provincial Gas and Water Companies 424
Edinburgh and Leith Gas Commission—The Appointment of an Engineer 426
Metropolis Water Supply—The Proposed Amalgamation of the London Water Companies 427
Cape Town Water Supply—Proposed Additional Reservoir . . 428
Notes from Scotland. 428
Current Sales of Gas Products 429
Coal Trade Reports. 429
Gas and Water Companies' Stock and Share List 429

PARAGRAPHS:—

PERSONAL: Mr. Thomas C. Severs; Mr. H. Stenning; Mr. W. A. Valon, J.P.; Mr. A. Lambie; Mr. E. J. Purnell; Mr. W. Tweed; Mr. J. Baird; Mr. J. Diggle 402
Correction—The "Electrician" Electrical Trades Directory and Handbook for 1897 . . . . . 4co
The Managership of the Cambridge Gas-Works—Proposed State Water Commission for New York—Midland Association of Gas Managers 405
The Generation of Motive Power with Blast-Furnace Gases—Manchester District Institution of Gas Engineers 410
An Anti-Rust Process 413
Institution of Mechanical Engineers—Gas-Engines and Modern Flour-Mills. 415
Water-Works for North Walsham—Stratton and Bude Water Supply 417
Gas-Works Extensions at Keighley—The Gas Poisoning Case at Leamington 419
Extensions at the Accrington Gas and Water Works. 421
Walsall Gas and Electricity Supply. 426
Gas-Works Extensions at Bingley—The Taunton Town Council and the Gas Company 428
The Gravesend Water Bill 429
Gas-Works Extensions at Droitwich—Projected Extension of Messrs Fletcher, Russell, and Co.'s Works—The Sale of Sulphate of Ammonia at Heywood—Reduction in the Price of Gas at Alresford (Hants)—The Bolton Corporation and Gas Deposits—The Proposed Additional Works of the New River Company 430
Northam Water Supply—The Progress of Gas Consumption in Manchester—The Proposed New Works for the Harrogate Water Company—Sales of Stocks and Shares—The Arundel Corporation and the Gas Company—Objections to the Leeds Improvement Bill—Employers' Liability Bill 431

EDITORIAL NOTES.

The South Metropolitan Meetings.

THE ordinary general meeting of the South Metropolitan Gas Company was held last Wednesday, followed by a Wharncliffe meeting to consider the Company's Bill in the present session of Parliament. Mr. George Livesey, the Chairman of the Company, presided; and there was a good attendance of proprietors. The Chairman's speech was studiously moderate in tone; giving hearers the impression that the speaker's desire was to shun controversial matter, so as to bring the ordinary meeting to a close as soon as possible, in order that the extraordinary meeting might be opened before the afternoon was far advanced. Mr. Livesey first spoke of the increased consumption of gas in the Company's district, and proceeded to give some interesting information concerning the early history of the coal-tar colours industry—supplementing Sir Bernhard Samuelson's recent disclosures in this regard. He next dealt at some length, and with much emphasis, on the question of rating; taking the opportunity for hinting, not obscurely, that if certain outlying parishes supplied by the Company persist in increasing the cost of gas manufacture by forcing up the local rates, reprisals are possible in the form of a differential charge for gas. The proprietors were warned not to expect an increase of dividend, inasmuch as the Directors desire to dedicate all surplus profits to the reserve. This warning may have been intended for prospective as well as actual proprietors, with a view to prevent the undue appreciation of the Company's stock, which already stands at a price too high to please the best friends of the undertaking and the industry. The Chairman went on to defend the policy of the Board in placing their fresh capital with the consumers; and he concluded an interesting address with a repetition of the familiar observations upon the desirability of uniting the interest of the workmen with that of the Company. A desultory discussion followed; and the rest of the general business was hurried through.

The meeting was then made extraordinary, for the sole purpose of considering the Company's Bill to amend the Act of last year. The Bill was duly read by the Solicitor; and the reasons for its promotion were expounded by Mr. Livesey in his customary felicitous style of handling such matters. Thereupon the floodgates of irrelevant talk were opened. Proprietors insisted upon discussing over again the decided principle of Workmen Directors; and after one or two vain attempts to keep these speakers to the point, the Chairman allowed them to have their talk out. It ended, of course, in the meeting approving the Bill by a large majority. The only wonder is that the opponents of the Board on this point of their policy should have thought it worth while to waste their own and other people's time by reopening at this stage the purely theoretical controversy of the past year. The proprietors had already decided in favour of the Workman-Director policy—at any rate in theory; and what they were asked to do on Wednesday was merely to remove an obstacle placed by Parliament in the way of carrying this theory into practice. The "wisdom of Parliament" is a phrase used quite as often in the ironical as in the direct sense; and it is impossible to see any wisdom in the action of the Legislature which retained the image of the Workman Director while rendering it practically impossible to materialize him. If Parliament had rejected the whole proposal, there would have been some sense in the decision; but there was none in what was forced upon the Company in this regard in their Act of last year. To argue that there is any disrespect of Parliament involved in asking that the qualification of a Workman Director should be reconsidered at the earliest opportunity, is to talk nonsense.

It is possible to understand and to appreciate the position of those South Metropolitan proprietors who do not like the idea of admitting workmen in the service to a seat on the Board; but it is not possible to follow the argument that Parliament was right in sanctioning the principle while imposing such conditions as rendered it impossible to carry it into practice. Mr. John Ewart, who did his best at the time to defeat the proposal of last year's Bill—making himself the centre of the opposition to the Chairman's views—spoke out on Wednesday in support of the present Bill, which he concedes to be the

logical sequence of the legislation of last session. The correct thing for opponents of the Workman-Director idea to do will be to await events, and act accordingly. They are entitled to make their opposition felt at the proper time; but it is to be hoped that no more will be heard of such hypothetical monsters as those that have been conjured up by the fervid imagination of some terrified capitalists to frighten the South Metropolitan proprietary. It ill becomes persons of the capitalist order, who are, so to speak, born to directorates, to declaim about what they suppose Directors of a different origin and training might be supposed to do with the property committed, with strict limitations, to their charge. To do so is to invite an obvious retort. The world has seen the Workman Director at work; and it is by no means certain that his faults, such as they are, exceed in gravity those from which fee-hunting noble lords and the ordinary run of Company Directors are not exempt.

The Affairs of the Liverpool Gas Company.

Some curiosity will be felt with respect to the character of the proceedings at the half-yearly meeting of the Liverpool United Gaslight Company, held on Thursday last, by reason of the local controversy upon the subject of the carburetted water gas supplied by the Company. This was an opportunity for the ventilation of any grievance that had been entertained against the Company in this or any other regard; but, remarkably enough, there was very little complaint heard at the meeting. The chair was taken on this occasion by Mr. J. Barkeley Smith, in the absence through indisposition of Mr. Edward Lawrence; and the Chairman was careful to state that the adoption of carburetted water-gas manufacture by the Board was instigated by regard for the good of the undertaking as a whole. The unreliability of popular ideas respecting the quality of the gas supply was amusingly illustrated by the remarks of Alderman Stolterfoht and Dr. Manifold on this occasion. The former made himself the spokesman of the suffering people of Wavertree, who thought the water gas was detrimental to health. He was ready to aver that this product does not possess the same heating qualities as ordinary coal gas, on the ground of his own personal experience as a supervisor of a local School of Cookery. Unfortunately for the speaker, the Chairman was able to declare, in reply, that no supply of water gas had been furnished to the school in question. It was the same with the other critic of water gas. Dr. Manifold complained that the gas supplied to his house gave a "dirty, disagreeable flame." Again, there had been no carburetted water gas supplied to the speaker's neighbourhood. This sort of thing is a fair sample of what crops up the moment a prejudice is created against a gas supply. Whatever else may be truly said concerning carburetted water gas, it is certainly not true that the flame is either colder or dirtier than that of common or cannel coal gas. Quite possibly it pays the Liverpool Gas Company to make this variety of illuminating gas; but, if so, it is not because the Company are able to make anything out of it on the score of its supposed cheapness, but because it is advantageous all round—an advantage of which the consumers are the first to reap the full benefit. It would be much more satisfactory, as the Chairman of the meeting observed, if consumers of gas who fancied they had anything to complain of, would send to the office, where they could be attended to. There is, however, no way of getting advertisement out of this simple method of procedure; and there will always be people who will prefer the more public course of airing their supposed grievances at a public meeting, even at the hazard of being "sat upon" by the Chairman.

Railway Rates for Coal in Bulk.

A tremendous judgment of the Railway and Canal Commission on a question arising out of the carriage of coal by rail has lately been delivered by Mr. Justice Collins. When it is stated that the verbatim report of it occupies three-and-a-half columns of small type in "The Times," it may be inferred that we cannot pretend to do more than hint here at the nature of the issues involved, and the gist of the decision upon them. The matter was, to all intents and purposes, a re-hearing, with further particulars, of the 1895 case of *Rickett, Smith, and Co. v. The Midland Railway Company*, which raised the question whether railway companies are entitled to practically raise their coal rates by calling the ton 20 cwt. instead of 21 cwt. as formerly. As Mr. Justice Collins put it, in the former case the Railway Company had to justify a new arrangement whereby they only carried 162 cwt. for the 8-ton rate, instead of 168 cwt.—an allowance of 2 cwt. per truck being made for wastage. In the present instance, the Company sought to justify the rate based upon a further modification of this arrangement, by which they carry 164 cwt. instead of 162 cwt. per 8-ton truck—that is to say, 20½ cwt. instead of the old 21 cwt. for the ton rate. It was admitted that this means an increase of 2½ per cent. on the old rates; and this increased charge had to be justified as being "reasonable" within the meaning of the Railway and Canal Traffic Act, 1894. It hardly requires to be said that to prove or disprove the reasonableness of an increase of 2½ per cent. on railway rates for the carriage of coal in bulk is a big undertaking. It was not a question of law, but of fact. The applicants attacked the Railway Company, and the latter had to defend their rates by referring to the cost of working. It is difficult to conceive a more abstruse inquiry. Assessment is a mere schoolboy's exercise in comparison with it. Upon the Railway Company lay the onus of establishing the cost of working their mineral traffic at different selected periods, while the applicants had to criticize everything advanced by the other side—and all upon a margin of 2½ per cent. Mr. Justice Collins's review of the proceedings in the case is a masterly composition, well worthy of the study of any man who is curious to know what it is to be a Judge, "and a good Judge, too!" The effect of the judgment, in which Lord Cobham fully concurred, was in favour of the Railway Company.

The Second Reading of the Engines and Boilers Bill.

At the risk of horrifying those good people who cherish a superstitious awe of the decisions of Parliament, we venture to condemn as mischievous and futile the result of last Wednesday's vote of the House of Commons on the Engines and Boilers Bill. This is a measure which, as we remarked three weeks ago, is little more than a Trade Union scheme for creating a close corporation of enginemen and boiler attendants. As it stands, it could not be carried out without placing power-users, even in the smallest way, under the most irritating disabilities. The main objections to the Bill were stated cogently and only too mildly by Mr. Jesse Collings; but the House read the measure a second time—it was suggested, rather out of dislike of the right honourable member for the Bordesley division of Birmingham than for love of the Bill. This is one of the considerations which—whether or not the explanation is true in the case in point—do undoubtedly influence the House, especially in regard to the action to be taken with respect to private members' Bills, and hence tend to exhibit the nation's lawgivers in the occasional aspect of a pack of schoolboys. The responsibility that at present rests upon steam-users for the proper conduct of their business in this and every other respect is absolute and unlimited. They cannot get out of it by showing that they use only certificated plant and employ none but certificated servants. The unpractical nature of the movement which produced this Bill was betrayed by Mr. John Burns, who interrupted Mr. Collings's criticism of its provisions by inquiring "whether the right honourable gentleman was aware "that employers, to their credit, were sending their "engineers to technical schools." What, in the name of all that is reasonable, has attendance at evening classes, or the possession by any man of a certificate, to do with proving the capacity and trustworthiness of the man if employed to look after an engine and exhauster in a gas-works? If the Bill were to pass in its present shape, it would be a penal offence for a gas manager to call a man out of the retort-house to stoke up the boiler fire, to say nothing of giving an eye to a tar or liquor pump. The whole scheme of the Bill is Labourism run mad. In this instance, those who framed and supported the measure were able to depend to a considerable extent for additional support upon the general desire that engine and boiler accidents should, as far as possible, be prevented—a desire that members of Parliament share with the community at large. Vague aspirations of this kind are responsible for many rash and callow schemes of legislation which attract support from unpractical people in and out of the House less for what they are than for what they pretend to be. Sir Alfred Hickman has done good service in blocking the next step of the Bill, which is not likely to get much farther this year. The matter, however, is one that will certainly crop up again regularly till something is done.

The Chemist in the Future.

M. Berthelot, the French chemist who claims to have been the first discoverer of the existence of acetylene as a definite compound, has given to the world a collection of essays on things in general, which have been criticized in "Nature" as an indication of the last word of contemporary science upon the subjects discussed. Of course, the key-note of M. Berthelot's song of the actual and prospective triumphs of science is that science must rule over all. It follows from this proposition that the only proper study for mankind is science; and, further, that the population of the universe in the not too-distant future will consist of a race of students subsisting on chemical food, and employing their time in chemical research. The prospect of the exhaustion of the world's coal supply does not alarm M. Berthelot. He pictures with enthusiasm an epoch when "there will be no more coal mines, nor "subterranean industries, nor consequently miners' strikes! "The problem of combustibles will have been suppressed "by the combination of chemistry and physics." The central fires of the earth will be tapped, and all necessary supplies of energy will thence be derived. People will only have to press a button, and the cosmic forces will do the rest. Men will live on tabloids artificially prepared. Unfortunately, the success of this state of things is admitted to depend upon the discovery (not yet in sight) of "a spiritual chemistry, to change the moral nature of "mankind as profoundly as our chemistry will transform "material nature." Pending this consummation, it will be good discipline for us to go on getting our coal, and making the best use of it we can.

The End of the Hamburg Strike.

The subject having been repeatedly mentioned in these columns, it is desirable that we should record the fact that the Hamburg dockers' strike, which began on Nov. 17 last, ended with the unconditional submission of the men on Saturday, the 6th inst. This result is what we have expected from the beginning; and there is nothing to qualify, in the light of accomplished facts, in anything we have advanced in regard to this deplorable conflict. If working men and their professional leaders were capable of profiting from such experiences as this of the baffled Hamburg dockers and Socialists, they would find in it several valuable lessons. Unfortunately, history shows that the very people who stand in most need of this kind of instruction remain impervious to it, and consequently fall into the same errors over and over again. Strike after strike may result in disaster to the cause of labour, yet it is only the employers who seem able to learn anything from these terribly costly and painful experiments. Knowledge being power, the side which learns most from either victory or defeat will stand to win more easily another time. The first point to be noticed in this Hamburg object-lesson is the confirmation it supplies of the well-known observation that when men strike for a principle, and do not carry their point immediately, or within a very short time, they are bound to lose. Strikes for wages may occasionally be protracted over long periods, and end after all in what appears on the surface to be a victory for the men, or in a compromise which can be represented from their standpoint as a justification for their action. Strikes for the recognition of the Trade Union, or any similar political matter, must, on the contrary, obtain a snap triumph, or they must fail. Once let the employers overcome the inconvenience, or resolve upon resisting to the uttermost on the point of principle, and the end is really a foregone conclusion. It was so in Hamburg; and it will be so at Bethesda. Another point in the Hamburg case in which history has repeated itself is the failure of the strike funds to bear the strain, even though the strike payments were less than the half of what had been promised to the men. It is difficult to believe that half the strikes that are organized by the professionals who practise the art of agitation with such comfortable results for themselves would come off if the men realized beforehand how inadequate the strike pay would prove, and how quickly it would "grow small by degrees and "beautifully less." Of course, the Hamburg wire-pullers do not suffer any personal inconvenience from the collapse of the revolt. We read that "the Socialist organs of the "Press, while acknowledging defeat, express satisfaction "with the course of the 'honourable fight' against "Capital." They are all right. They have sold some fat editions, and have helped to work up a few reputations that may well be expected to be worth money. There is some satisfaction in the reflection that Mr. Tom Mann, though desperately anxious to be "on" in the Hamburg scene, was kept completely out of it. There are enough agitators "made in Germany" to share out the pickings of the Hamburg job; and there is no opening on the Continent for a branch establishment of our agitators' ring.

WATER AND SANITARY AFFAIRS.

The second reading of the Water-Works Purchase Bills of the London County Council, entered on the Order-book of the House of Commons for Thursday last, underwent two postponements, first to the 4th of next month, and afterwards to the 11th. This change of date is understood to be for the convenience of London members. It may also suit some other purpose; and a delay of three weeks seems rather remarkable. Up to the time of going to press last evening, there were no further tidings of the Government measure; and the whole subject remained open to conjecture. Uncertainty must at least end by the time the Purchase Bills come on for their second reading. It is argued in some quarters that the election of Mr. Shaw-Lefevre for the Haggerston vacancy on the London County Council is an endorsement by the electors of the Progressive policy respecting the water supply. On the basis of this theory, the Unionist members are being warned not to oppose the Purchase Bills. Apart from any such warning, it is likely enough that the Bills will pass the second reading, and go to a Select Committee, together with any other measure that may bear on the question. Yet "The "Times" stated a week ago that the London Unionist members had entered their protest against an assent being given by the Government to the second reading of the Purchase Bills under any conditions. "Things are some-"what complicated," we are told. This agrees with our own remark at the same date. Mr. Sydney Buxton has charge of the Purchase Bills, and respecting one which proposes to enable the Council to buy out the Companies with County Council stock, he has given notice to move the suspension of a Standing Order, which would require this Bill to be brought in as a public measure. With regard to the general scheme, an excellent letter has been addressed to "The Times" by Sir F. Bramwell. The communication offers little beyond what has been already advanced in these columns; but it derives importance from the reputation and position of the writer. Sir Frederick expresses his conviction that if the inhabitants of the Metropolis were wise, they would leave the water undertakings in the hands of the Companies. But he suggests that it might be possible to effect an improvement by combining the eight undertakings into two—one for the north and the other for the south side of the Thames. If popular sentiment becomes so strong in favour of transferring the supply to a public body as to be irresistible, Sir F. Bramwell says emphatically: "I do trust that "Parliament will not for one moment allow the Companies "to be acquired by the London County Council." He urges this partly for the reason that the Council are pledged to introduce some new source of supply, thereby involving the ratepayers in an enormously increased annual charge for water. It is remarked that the County Council were so opposed to the Staines reservoirs scheme, that, if they were placed forthwith in possession of the water supply, they would be logically bound to stop those works. It is to be hoped the letter embodying these views will receive due attention, both in and out of Parliament.

The London Water Companies Amalgamation Bill, backed by Sir F. Dixon-Hartland and others, contained, as first printed, a curious error, three of the Companies being omitted from the list of eight supposed to be given in the definition clause. A second edition of the Bill (a full summary of which appears elsewhere) corrected this oversight. The scheme proposed consists in a re-arrangement of the London Water Supply, without buying up the undertakings or superseding the Companies. For the purpose of determining the matters which are to be referred to arbitration, an ex-Lord Chancellor, Law Lord, or member of the Judicial Committee of the Privy Council, is to be appointed by the Board of Trade as sole Arbitrator, whose decision in all matters is to be final, unless this authority shall himself desire a decision of the High Court. There is to be a grouping of the Metropolitan Water

Companies; the Chelsea, Grand Junction, and West Middlesex Companies being amalgamated into one Company, and the Kent, Lambeth, and Southwark and Vauxhall Companies into another. The East London and the New River Companies are to form a third amalgamation; or, in the discretion of the Arbitrator, the New River Company may remain a separate undertaking, in which case the East London Company are to be joined to the Chelsea, the Grand Junction, and the West Middlesex Companies. A further combination is provided for, by permission for all the northern Companies to unite; but it would seem as if this would not necessarily include the New River Company. More comprehensive still is the provision that, if the Arbitrator so directs, all the new Companies "shall," within five years, be amalgamated into one Company. The compulsory term "shall" also applies to the threefold amalgamation first specified, and this is to take effect within one year after the passing of the Act. But within a period six months earlier than this, or at a later date if allowed by the Arbitrator, it is required that the Companies shall submit schemes for effecting the proposed amalgamations. In fulfilling this obligation, the Companies "may" submit schemes, jointly or separately, in accordance with the objects of the Act. There seems to be some needless complication in this part of the Bill. The clearest point of all is the power vested in the Arbitrator to make all the Companies amalgamate into one within five years. But even this requires a preliminary amalgamation, creating what are called "new" Companies.

A very useful provision in the interests of the public consists in the requirement set forth in the Amalgamation Bill that the water supply of the Companies shall be interchangeable. In any event, the Arbitrator is to effect the necessary arrangements for this purpose; provision being made, as he thinks fit, for the due supply of water by each Company to the other in time of scarcity. The general control of the combined undertakings is to be vested in Boards of Direction formed out of a selection from the old Boards, supplemented by Directors appointed by the Board of Trade. The financial arrangements proposed by the Bill are intended to secure the present rates of dividend and interest; surplus profits being applied to the formation of a reserve fund. While this fund maintains a certain proportion to the capital, the remaining profit is to be applied in reduction of the charges for the supply of water. Another feature in the plan consists in the appointment of a water "Referee," to hear and determine all complaints made by Local Authorities against the Companies—such decisions to be subject to appeal. The ratepayers may at least be congratulated on the fact that the scheme does not involve any addition to their local burdens. So far as the Companies themselves are concerned, it has always appeared to us that amalgamation would strengthen their position. The Bill serves a good purpose, in showing that the transfer of the water undertakings to a new authority is not necessary on any ground in the interests of the public, though some change in the present system may be effected. "London" says of the Bill: "This is another scheme to "prevent the public getting control of their water supply." Certainly it does not open the way for the County Council to get possession.

Correction.—In the table appearing in the summary of Mr. G. P. Lewis's lecture on "Artificial Illumination" as published last week, a mistake was made, by inadvertence, in the line "Incandescent Gas Lighting under favourable conditions." The word "gas" should have been "electric;" and the figures following will show the importance of this correction.

The "Electrician" Electrical Trades Directory and Handbook, the fifteenth annual issue of which (for 1897) reached us last Saturday, has been commended on several previous occasions for the mass of information it contains. In the present edition, which has been corrected up to the 31st ult., several important matters are dealt with for the first time. Among these may be specially mentioned the sheet table which furnishes particulars (corrected up to the beginning of this month) of the electric supply stations of the United Kingdom, a revised digest of the law of electric lighting and power supply, and the latest rules of the British, American, Canadian, French, and German Fire Insurance Corporations relating to electrical risks. Great care has been bestowed in making the statistics referring to the engineering and finance of electricity supply undertakings unusually complete. The directorial division of the book contains a revised list of individuals and firms engaged in electrical science, engineering, and industry throughout the world. The book is published by the "Electrician" Printing and Publishing Company, Limited, Salisbury Court, Fleet Street, E.C.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 429.)

The week just closed has naturally been one of considerable agitation on the Stock Exchange; but, taking all things into consideration, the markets have borne the stress a great deal better than might have been the case. At first, the imminent application of the Greek match to the European powder magazine produced much alarm; and there was a bit of a rush to sell. But upon the steps taken by the Great Powers to intervene becoming known, a better feeling prevailed. From this point to the close of the week, the markets remained in a state of suspended animation; the ruling disposition being to wait and see what is going to happen next. Thus prices all round have suffered—some directly and some indirectly through sympathy; but the fall, though general, is not severe. Money is in pretty good demand; and rates are steady. Business in the Gas Market opened rather brisk, and afforded fair promise of activity; but later on it fell away to more slender proportions, and closed quiet. Movements were a little irregular; but in no case was there any very marked alteration in prices. In Gaslights, there was a good deal done on Monday at figures which showed not much variation from those of the preceding week; but the quotation was put down 2 points. Thenceforward to the close, the prices remained poised at about middle figures—say, 315½. The secured issues came in for a little attention; and some of the 10 per cent. preference rose in value. South Metropolitans were rather more active after the meeting on Wednesday, and managed to top the level 150 by half a point. The next dividend will be a shilling better than the last. Commercials offered no feature for remark. The Suburban and Provincial division were quite stagnant, and hardly any business was marked in them. Among the Continentals, Imperial lost ground, and the quotation was materially lowered; but actual prices marked did not show equivalent reduction. Of the other undertakings, Malta was weaker; but Bombay had a rise. Water stocks were quiet. Quotations moved very irregularly; but the prevailing tendency was downwards—Grand Junction and East London leading the way with a liberal reduction.

The daily operations were: Transactions in Gas were busiest on Monday; and things were dull. Gaslight "A" receded 2; and Malta, ¼. East London Water fell 4. Business was much quieter on Tuesday; but prices did not show much change, though Imperial Continental moved back 1. Grand Junction Water fell 3. Wednesday was about the same. South Metropolitan rose 1. In Water, East London debenture gained 1; but Southwark debenture had a relapse of 2. Transactions remained just as limited on Thursday. The changes in price were a rise of 2 in Gaslight "C," "D," and "E;" and ½ in Bombay new; but Imperial Continental was ½ lower. In Water, Southwark rose 2; but Grand Junction fell 1, and West Middlesex 2. Friday was a busier day in Gas; Imperial Continental losing 2 more. Water was flat—East London losing 3; and Grand Junction, 1. Saturday was uneventful; and quotations closed unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Financial Aspect of Electric Lighting—Finances of the City of London Company—The Paying-Off of the Preliminary Expenses of Electric Lighting Companies.

Those moneyed people who have faith in the "Financial News"—if there are any—must be grateful to the conductors of that newspaper for the remarkable display of prudence and foresight which was given in last Thursday's issue, when the first editorial article was devoted to proving the soundness of electric lighting as an investment. The evidence relied upon was, of course, the recently published reports of the leading Metropolitan electricity supply companies. The article begins with the statement that "electric lighting has not taken many years to demonstrate its claim to rank among the industries in which investors may place their money with comparative safety." The public has a short memory, happily for party politicians, financiers, and other enterprising orders of the community dependent for their existence upon their success in gaining the confidence of their contemporaries; but it is a little too glaring a pretension that the prosperity of a few electric lighting concerns in the best parts of London should be taken to represent the financial history of the business as a whole. What about all the earlier demonstrations of the Brush era? and what about the actual state of the London Electric Supply Corporation? The truth of the matter lies in the proverbial nutshell. Where the district is a good one—and the best district in the world is not too good for the purpose—and where the system of supply is suitable and properly conducted, electric lighting will pay a reasonable profit. But it is impossible to infer the financial success of one such undertaking from that of another. Every electric lighting speculation must be judged by its own

circumstances. We have never thrown doubt in these columns on the prospects of the St. James's and Pall Mall, the Westminster, or the Charing Cross and Strand Companies, for obvious reasons. Now the City of London Company claim a place in the "first flight" of electricity supply undertakings, and propose to signalize their arrival at the stage of being able to pay a 7 per cent. ordinary dividend by increasing their capital by £400,000.

This decision is warmly applauded by our financial contemporary, which is good enough to state that the proposal "is likely to be hailed with acclamation by the shareholders." In order to make quite sure of this, the Directors are nobly going to deprive the undertaking of the chance of profiting by a premium issue. "At first, only £100,000 is to be issued; and the shares are to be offered at par to the present proprietors, in the proportion of one new to four old. The Directors could obtain a substantial premium on the new capital; but it seems good policy to give an appreciable bonus to those who joined the enterprise while it was yet in an experiment stage. The privilege is unmistakably substantial, for the shares have stood about 17 lately; so that by getting one new share at par for every four, the proprietors receive a bonus of roughly 35s. a share, which would make the return for the year nearly 25 per cent. The shareholders may be congratulated on a slice of exceeding good luck." An extremely plausible statement, which might almost have been "inspired," so plainly does it convey what is evidently the official view of the situation. Doubtless the policy of the Board will be warmly applauded by the objects of their benevolence; and doubtless the market value of the City of London Company's ordinary shares after the new issue will stand higher than ever. Meanwhile, it may not be out of place to remark that another contemporary, the "Electrician," which publishes a useful table of electricity supply statistics, has never yet been able to obtain from the City of London Board the same information as to business done that the Directors of other Metropolitan Companies have been willing to afford. It is known, however, that the Company's capital burden is pretty heavy as it is—much of it being unrepresented by assets; so there is plenty of room for justice in the disposition of any trifles in the nature of premiums on fresh capital issues that may be realized, before there can be said to be any call for the display of generosity to shareholders.

At the recent meeting of the National Electric Supply Company, who, for all their grand expanse of title, appear to confine their operations to the town of Preston, an interesting disclosure was made illustrative of the vigilance of the Board of Trade in regard to the affairs of statutory electric lighting companies. The Chairman had to begin his speech by stating that, since the report and accounts were issued, the Official Auditor had informed the Board that no dividend could legally be paid until the whole of the preliminary and formation expenses had been written off; and that the Board of Trade were insisting on this being done by all electric lighting companies in the accounts for 1896. This decision took the Preston Board by surprise, inasmuch as they had proposed to declare a dividend while paying off only a portion of the expenses referred to, as other companies have done in the past. In the new circumstances, there was felt to be nothing for it but for the Board to take back their report, and make arrangements for reducing the subscribed capital by the amount required to clear the expenses in question. This piece of intelligence is hailed by the "Electrician" as a further step on the part of "our most paternal Government Departments." It is nevertheless constrained to admit that the course insisted upon is a proper one. "Very possibly the demand may bear with some severity upon small struggling concerns doing a sound business, but hoping to raise further capital on easy terms upon the strength of a dividend." It is not only "small struggling concerns" that are prone to indulge such a hope. In point of fact, the Board of Trade Auditors have put their finger upon a tender spot in electric lighting company administration. A good many such concerns have been compelled by force of circumstance to draw upon capital while developing their business, which is indeed the natural thing to do when new industries are being established. There should, however, be limits to the process, which in the case of this particular industry it has not always been easy to bring within sound financial bounds. The moment the bulk of business secured is such as to enable a substantial profit to be shown, the temptation to offer the long-suffering proprietors a little dividend becomes almost irresistible, even though the capital account is unduly inflated. It needs more backbone than the average director possesses to recommend shareholders to abstain a little longer from dividing the fruits of his own good management on their behalf. There can be no doubt, however, that the attitude of the Board of Trade in this regard is correct. The first time an electric lighting undertaking turns the corner and earns an apparent profit is the occasion when the capital, preliminary expenses, and depreciation accounts should be looked carefully into. It is possible, indeed, that a central station may be in a better working condition three or four years after starting, before anything has had time to wear out, than it would be some years later. Only the most prosperous concerns of the kind have as yet been able to follow the policy suggested by these considerations; but unless others do so to the best of their ability, a transient gleam of prosperity may only lead them into ultimate disaster.

THE SECRET OF PROGRESS.

An admirable article, "The Records of Experience," appeared a short time since in the editorial columns of our contemporary "Engineering;" and we have waited for an opportunity for bringing some of its matter under the notice of readers of the "Journal." The recent address of Mr. J. W. Helps to the members of the Southern District Gas Managers' Association, and the reflections to which some of the suggestions offered by him give rise, supply the occasion desired; and we therefore propose to briefly discuss the office and work of technical societies in the light of our contemporary's observations. For it is obvious that one of the principal objects subserved by the technical societies which are so conspicuous an element in the development of the gas engineering of the present day, is that of providing an agency for the collection and placing upon record of experiences that might otherwise remain mere individual possessions. Hence it is of particular interest for all members of such societies to be reminded of the paramount importance of records as bases of progress. "Permanent civilization," says "Engineering," very truly, "is based on records, just as individual progress is based on memory. . . . A people whose knowledge is entirely traditional need to be very favourably situated for a continued and progressive existence. If placed amid new and adverse circumstances which give a severe check to their industrial life, the probability is that they will suffer a rapid decline." An illustration in point is supplied by the history of the mediæval trade guilds. There was a time when every industrial occupation was made a "mystery," as the terms of apprenticeship indentures in many instances still witness. The secrets of the trade were passed on from father to son, from master to apprentice, with the most extreme jealousy of the uninitiated. "The result was utter stagnation. Generations passed without an improvement; and when in a particular art some genius arose who introduced new methods or materials, his secret died with his children or grandchildren." It is notorious that gas manufacture has had such a stage of development to pass through. In many an old gas-works there has been kept for years some absurd "secret" cherished by an old manager or foreman as constituting the key of his position. In one case known to us, it was a piece of slate weighted with half a brick and luted down over a hole in the hydraulic main. This was an infallible safeguard against a dangerous rise of pressure between the purifiers and the retorts. Of course, the younger race of gas managers are superior to such puerilities. But perhaps they hardly realize at all times how much they and the world at large owe to the growth of the modern fashion of recording and publishing experiences, or they would do more in this way.

Our contemporary puts it as "one of the merits of technical colleges" that they have taught engineers how to record. "They have diffused the judicial attitude of mind which takes note of every germane fact, be it favourable or the reverse, to the hopes and prejudices of the experimenter. Further, they have trained and sent into the world a body of men free from the superstition that knowledge should be hoarded in the recesses of the mind or in secret note-books." We can hardly agree to this presentment of cause and effect. Rather would we ascribe the foundation of technical colleges to the antecedent conviction of the technical world that the circulation and extension of knowledge is more profitable than the secret hoarding of it. Doubtless, technical colleges do teach students how to observe and record. But they could not have originated the idea that observing and recording are the correct things to do. Our contemporary very prudently draws the line somewhere short of the publication by every individual, in all circumstances, of all he knows. It might not pay him to do so; but the chances are that the very people to whom this prudential consideration would most strongly appeal are those whose knowledge does not amount to much. They are the "knowing ones" to be met with in every industry, who are apt to be found in a small way of business to the end of their career, while their more liberal minded contemporaries are far ahead of them. The best course a man with a really valuable bit of exclusive information can follow is in the first place to make sure of it as his own property; and then to exhibit it, so to speak, in his shop window. No man engaged in a modern industry can carry it on upon the secret basis of an exclusive knowledge. His secret is certain to be blown upon sooner or later. Hence if anybody has a device of his own which appears to be good for anything, it is best for him to patent it. If he has experience of, or ideas in regard to, less tangible matters, it is better for him to publish them under his own name than to hug the delusion that by keeping them to himself he will thereby become wiser than his fellows.

Publication of such matters may not produce immediate profit; but it helps to make a reputation, which is just as valuable in the long run. "The sole way to acquire a fortune is to make a reputation; and reputation has to be paid for. One way for the engineer to do this is to present the profession with the records of experience." This is, indeed, almost the only possible way by which a man can show himself out of "the ruck." Every member of a technical society, at any rate, has the means at hand for opening out a career commensurate with his abilities. If a society of this kind is nothing else, it is at bottom a republic in which the way to distinction lies open equally to all

the citizens. It is absolutely and wholly his own fault if a member of a technical society remains unknown and unconsidered. Of course, the picture has another side; and few professions are destitute of specimens of the kind of plausible charlatan who thinks vastly more of his inventions and papers than other people do. These individuals sometimes have to be borne with for a season, and they seldom do harm to anybody but themselves.

Assuming experience to be genuine, and to be of proved value to the possessor, our contemporary advises that no time should be lost in promulgating it. "Hoarded experience is not like the miser's gold; it does not conserve its value for ever. It may be more aptly compared to a collection of bygone garments. In a short period, the changing fashion of the times prevents its being used without great modification. In looking through a series of old note-books, how little one finds of any direct use; and how often the regret shapes itself in one's mind that the opportunity was neglected of embodying certain of the information in a paper, and reading it before a technical society, or in some other way of ear-marking it with one's own name." After all, the experience that can be put upon paper is the least valuable part of knowledge, because the times move on even while one writes; and the man is always and necessarily greater than his record. "A man may put down on paper all he knows with perfect candour and exactitude, and yet keep ahead of competitors. He cannot divest himself of the advantage he gained by the pursuit of his knowledge; and he cannot transmit this to others. His records may be models of lucidity; but they do not convey to the world exactly what they represent to him. In his case they are experiences; in that of his readers they are knowledge only." Naturally, the man who has learnt the truth for himself is wiser than he who merely gets it by hearsay.

"The value of experience is mainly educational, and only secondarily instructional. It is but for a short time after a technical discovery that its author can make direct use of it. Very soon he must introduce modifications and institute further researches in order to keep up with the times." Even a Rayleigh, a Ramsay, or a Röntgen soon ceases to be regarded as an authority upon the character of his own special discoveries, unless he keep working at it, and adding to the sum of knowledge. To this order of considerations our contemporary assigns the explanation of the rarity of master-patents. "Every year there are from 20,000 to 30,000 applications lodged at the Patent Office; but those which cover all the possible lines of progress in some particular industry, and which cannot be eluded, are to be counted on the fingers of one's hands. Among those of secondary rank—that is, patents which give their possessors considerable advantages over their commercial rivals—how few maintain their value nowadays for the full fourteen years!" Patent rights, it is observed, are the price paid by the State to secure full records of all attempts at industrial and technical progress; and, on an average, the term is regarded as ample.

There are some who profess to scout the encouragement of the publication of technical records by societies as unnecessary, and especially to despise the technical Press as pernicious. This is pure reactionism, and spells ignorance and loss. Some manufacturers, also, jealously exclude possible competitors from their works, lest they should pick up something valuable for ulterior uses. Upon this point our contemporary recalls the experience of the British iron trades deputation to Belgium and Germany, when the members—somewhat to the surprise of many—were received with effusion and shown everything. These foreign firms "probably were quite satisfied that British manufacturers should endeavour to copy their systems and follow their processes; knowing full well that the operation must be slow and tedious, and that before it was complete they would have advanced another stage, and would be as far ahead as ever. The man who follows another's lead is necessarily behind; and it is by no means bad policy to encourage the practice. If you give a man your second-best suit of clothes, you can always appear better dressed than he." Wise words! We remember on one occasion, after having been shown over a factory in which a special class of goods was being manufactured, remarking on the ease with which the plant and processes might be copied by an unscrupulous visitor. "That is true," was the reply of the Manager; "but it has taken us seven years to get as far as this, and we are not finished yet. I cannot believe that anybody else would be able to make faster progress than we; and before seven years everybody will be welcome to the use of such plant and processes as these."

Apart altogether from trade considerations, it is better to give to the world the records of experience in whatsoever form may be most fitting. If knowledge takes the shape of invention, it is best to patent it before anybody else supersedes or gets wind of it. If experience and its fruits cannot be dealt with in this way, then they should be given to the world at the first convenient season. "When the first fruits have been reaped, it is sound finance to barter what remains for reputation. The gain to the community by such a course is immense, as it furnishes stores of knowledge which will exist for all time." The vast bulk of physical, mechanical, and chemical knowledge that has been gained during the present century is mainly due to the happy habit of treating discovery and experience as seed corn, whereby every little fruit of ingenuity and labour, instead of being consumed as gathered or left to rot in store, has been encouraged to yield increase many hundredfold.

PERSONAL.

Mr. THOMAS C. SEVERS, of Morley, near Leeds, has been appointed Manager of the Newent (Glos.) Gas-Works.

Mr. H. STENNING has become Vice-Chairman of the Redhill Gas Company, in place of the late Mr. F. B. Hallowes.

The current number of "The Biographer" contains an appreciative biography of Mr. W. A. VALON, J.P., of Ramsgate.

Mr. A. LAMBIE, who has been for many years with the Troon Gas Company, has been appointed Manager of the works.

The Coventry City Council last Tuesday appointed Mr. E. J. PURNELL (who is resigning the office of City Surveyor) to the position of Water Engineer, with entire charge of the works.

Mr. W. TWEED is retiring from his position as Secretary to the Epping Gas Company; and, as a token of their appreciation of his able and faithful services during the twenty years he has been connected with the Company, the Directors and shareholders have presented him with a silver inkstand.

At the conclusion of the ordinary business at the recent meeting of the Brompton, Chatham, Gillingham, and Rochester Water Company, the Chairman, Mr. J. BAIRD, presented a splendid oil painting of himself to the Company, as a memento of the able co-operation afforded him from the formation of the undertaking. The Chairman, who has held the office since 1866, mentioned that in 1881 he was presented with an oil painting of himself by the Directors and staff.

Mr. J. DIGGLE, who has for some years held the joint position of Borough Surveyor and Water Engineer at Heywood, with the privilege of undertaking private work, has been relieved of the duties appertaining to the former office, and will now devote the whole of his time to those connected with the water engineership, unless otherwise sanctioned by the Water Committee. No change is made in the salary; but he will receive a commission on new engineering work undertaken by him.

NOTES.

The Effect of a Smoky Atmosphere.

Mr. A. E. Outerbridge, junr., has contributed to the "Engineering Magazine" a paper on the advantages of mechanical stoking, in which the familiar arguments in favour of smoke prevention are repeated. It is stated that the citizens of Pittsburgh were afforded a grand object-lesson during the reign of natural gas, by the increased comfort, cleanliness, and healthfulness of the city resulting from the substitution of a clear atmosphere for the smoky pall in which they were formerly, and are now again to some extent, enveloped. Very recently, Mr. F. W. Duenckel, the observer in charge of the Forest Park Meteorological Observatory, near St. Louis, has noticed that there were, at times, greater differences between temperature readings at his station and those at the United States weather bureau in St. Louis city than were warranted by the intervening distance of 4¾ miles. These readings have been plotted for some years, and show that in calm weather the smoke from factories hangs over the city, preventing radiation and consequent cooling at night, and refracting the sun's rays during the day. This interference with radiation, Mr. Duenckel considers detrimental to health—to say nothing of the injurious effect of the carbon in the atmosphere. It appears that, while the Municipality of St. Louis have decided that the emission of dense black or thick grey smoke from boiler-furnaces is unnecessary, inasmuch as the stoking can be better performed by mechanical devices which result in the smokeless burning of the fuel, exception must for the present be made for certain metallurgical operations, and also for particular kilns and muffles.

Superheated Steam.

Professor William Ripper has been instructing the Institution of Civil Engineers on the merits of superheated steam for use in motor engines. He pointed out that its use has been in abeyance for the last thirty years, during which time a continually increasing gain in steam-engine efficiency has followed the development of the multiple-expansion engine, and the increase of steam pressures. The limit of practical efficiency having been now nearly reached in this direction, steam engineers are again reverting to superheating, as a means of further increasing the efficiency of the steam-engine. Professor Ripper has been experimenting with a single-acting, non-condensing, simple engine of 17-horse power, with the object of determining the steam consumption for different degrees of superheating, and other elements in the question of the expediency of the process. It was observed that no important gain could be theoretically expected from superheating; the actual benefit of it being due in practice to the more or less complete prevention of cylinder condensation. When steam is superheated, it is in a more stable condition than when it is without superheat; and if there is sufficient excess of heat, the steam in the cylinder becomes practically dry at cut-off and release. The amount of heat-exchange between the steam and the cylinder walls is at the same time reduced to the minimum. It has been found that the superheating of 120 lbs. of steam to a temperature of 674° Fahr. on entering the cylinder reduced the consumption from 38·5 lbs. without superheat to 17·05 lbs. per indicated horse

power per hour; the rate of decrease of steam consumption with increase of superheat being approximately uniform within certain limits. The practical difficulties supposed to be associated with the production and use of superheated steam have been satisfactorily overcome. With ordinary care for the purity of the feed water, the superheater tubes last well; and with good mineral lubricating oils, no trouble is experienced in the steam cylinder. The best results are obtainable when the steam is supplied to the engine at a temperature of about 650° Fahr.

The Effect of the Atmosphere Surrounding an Electric Arc.

Mr. W. E. Wilson, F.R.S., and Mr. G. F. Fitzgerald, F.R.S., have communicated to the Royal Society a paper on the observed effects of altering the nature and pressure of the atmosphere surrounding an electric arc light. The authors describe experiments upon the arc light in air, oxygen, hydrogen, and carbonic acid gas. It has been found by previous observers that NO_2 is formed when the carbon arc is produced in air; and these experiments prove that, with air and oxygen at high pressures, such large quantities of NO_2 are formed in this way that observations of the radiation at these pressures is impossible. Experiments in the same way with hydrogen, showed that in this gas the arc is long and thin, with a red line down its centre. Observation of the crater of the carbon in hydrogen at high pressure was impossible, because, in the first place, only a very short arc could be maintained, and, secondly, soot trees and a deposit of graphitic carbon all round the margin of the crater at high pressures completely hid it. The experiments in carbonic acid at high pressures were the most satisfactory; but owing to a variety of difficulties, it was found impossible to decide with certainty whether the crater itself was hotter or colder at high pressures. A thermodynamic investigation of the conditions of the electric arc in an atmosphere at high pressure indicates that by the theory the temperature of the crater should rise 220° C. for every additional atmosphere of pressure, and that the radiation should double for an increase of four atmospheres. Such a large increase would have almost certainly been detected by the authors; but nothing of the kind was noticed.

Photography in Natural Colours.

It appears, by a recent communication in "Nature," from Sir H. Trueman Wood and Captain W. de W. Abney, that another step has been made towards the realization of the photography of natural colours. When we last mentioned this subject in a "Note" (see *ante*, p. 123), it was to chronicle the success of Mr. F. E. Ives in making coloured spectroscopic projections of natural objects. The new process is claimed to be a true method of photography in colours—at least, it is a process that goes beyond spectroscopic projection as practised by Mr. Ives. Colouring media are employed, so that the process is not wholly photographic; but it is claimed that for all practical purposes, the long-sought object of photograph research—photography in colour—has been attained. The inventor is M. Villedieu-Chassagne, of Paris, who has developed a process originally suggested by Dr. Adrian Dansac. He takes a negative on a gelatine plate, which is developed and fixed in the ordinary manner. It shows not a trace of colour. From it a positive print or transparency is taken, which is then washed over successively with three coloured solutions of the primary colours of the spectrum—red, green, and blue. These colours are taken up in due proportions by the different parts of the picture, and combined into the presentation of the proper tints and shades. Captain Abney corroborates this testimony, and confesses that he saw the process done and was "partially convinced" of its correctness. The whole thing must appear a puzzle to students of optics. It was difficult enough to understand the reason of Mr. Ives's success. But he had light to act as the blender of the colours in his plates; whereas in the later process it is the print itself which appears to select them.

The Most Expensive Manufactured Product.

Those inquirers after knowledge to whom the curious is more attractive than the merely instructive, are much given to ask such questions as: "What is the most expensive manufactured product at present made in the world?" and so forth. For a long period the answer to this particular query was "steel hair-springs for watches;" and note was duly taken of the circumstance that it is labour alone which makes these steel articles so costly. Of late years, it appears that the hair-spring has had to yield its pre-eminence as the most expensive of all products of manufacturing industry to another commodity made from a raw material cheaper even to begin with than the steel billets intended to be worked up into chronometer springs. This is the carbon filaments that are used for incandescent electric lamps. According to M. Wilfrid Fouvielle, these filaments are made as an article of commerce in Paris, where they sell wholesale by weight, at so much per gramme, according to the tenuity required for different sizes of lamps. The filaments for the small electric lamps used for portable lighting, which are rated at 3-candle power, are so light that there would be 1,500,000 of them to a pound. The filaments for 20-candle lamps are worth £1600 per pound; and those of 30-candle lamps, £2400 per pound. Such is the substance of the report on the subject of Mr. Morris, the United States Consul for Ghent. It only remains for the same ingenious gentleman to work out the value per pound of incandescent gas-burner mantles after the sizing has been burnt off.

COMMUNICATED ARTICLE.

STOPPAGES IN ASCENSION-PIPES.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

The various correspondents who have replied to the question raised by a "Country Manager," do not appear to have appreciated the fact that the trouble is only experienced during the busy season, and that at other times the retorts work very well, which seems to indicate that certain unfavourable conditions obtain during the winter and at no other time. Without some direct acquaintance with the particular case in question, it is scarcely possible to do more than indicate in a general way some of the common causes of "chokes;" but the following considerations are offered in the hope that the propounder of the query, as well as others who experience similar difficulty—for I believe the trouble is a common one in small works—may find among them some hint or suggestion that may prove useful.

This subject is usually approached from one standpoint only—that of the condition of the apparatus; and the sufferer is advised to have larger dip-pipes, to lift his hydraulic, or to make other structural alterations. But it is probable that methods of working, and the manner in which the retort-house men discharge their duties, have much or more to do with the difficulty than defects in the design of the apparatus. There are several works throughout the country, having small dip-pipes, hydraulic mains reposing on the brickwork of the settings. and perhaps no exhauster, and thus presenting a combination of all the circumstances, so far as design of apparatus is concerned, that are generally supposed to be favourable to choked pipes, but which in spite of all manage to get on very comfortably. While in other cases, notwithstanding every refinement of modern design, a great deal of difficulty is experienced.

I presume that a "Country Manager" has looked up some of the published matter on this much debated question—it would consume a fortnight's leisure to read the whole. At least a dozen papers and discussions respecting it will be found in the proceedings of our Gas Managers' Associations. It was before the British Association of Gas Managers in 1871, 1873, 1874, and 1881. The North of England Association tackled it in 1891, and the Southern Association in 1885; while the "late lamented" South West of England Association had it before them in 1884 and 1888. Our American brethren have had a great deal to say on the subject; and in France and Germany it has been as much a vexed question as in our own country. When we glance down the advertisement columns of a newspaper or current magazine, and see the number of perfect cures that are advertised for almost every known disease, we wonder why folks continue to be ill or how doctors manage to get a living, when the remedy is to hand for 1s. 1½d. or 2s. 9d. as the case may be. And in a similar way, when looking over the literature above instanced—which includes not one but many "perfect cures" for the difficulty—we wonder how it is that, at this period, anyone should be driven into that pitiable state of distraction so feelingly described by a "Country Manager." To carry the medical simile a step farther, there was a shrewd old gentleman who used to say that he could prescribe rest and low diet for himself, whenever he needed it, without paying a doctor to do so; the inference being that the benefit afforded by such a mode of procedure was chiefly to be credited for the return to health, which is generally ascribed to the virtues of the medicine. And similarly, it may happen that when a gas engineer puts up some pet remedy—I will not say nostrum—of his own, and drops into the retort-house to see how it is working some two or three times a day (or about twice as often as he was used to do), the mere fact of his more frequent presence induces a greater degree of care in such matters as attending to the furnaces, cleaning the flues, using the auger, apportioning the charges, and other little details that will be apparent to all who know anything of retort-house work, that may of themselves contribute in no small degree towards the improved results for which the new contrivance takes the sole credit. How many inventions could be instanced, that gave wonderful results so long as they received special care and attention, but dropped into a very ordinary position so soon as this was withdrawn. So it is quite possible that more careful or regular supervision would of itself effect some improvement, without the help of any "patent" medicine. And I am the more inclined to attach importance to this suggestion, through knowing from experience that the retort-house must of necessity go with less supervision in the busy season, though for several reasons it should have more. Just at this time the odd winter hands come in—some new at the work, and none inclined to be so careful of the interests of the concern as the regular all-the-year-round men who have a constant job, which a wise manager will have arranged shall be worth a little more than they could get elsewhere in the district. Unless some care is taken, things are apt to get a bit slack all round; and the men think more about saving themselves trouble than of the comfort of the manager or the dividends of the shareholders. But with the advent of cold weather, the purifier-house operations require daily supervision; while at the same time, all sorts of complaints arise in the distributing department. The manager is continually being called away else-

where; while his clerk (if he has one) finds plenty to occupy his time in the weigh-house and coke-yard.

Let it now be assumed that a far-seeing directorate have provided a staff equal to dealing promptly and efficiently with the numerous demands that arise at the commencement of winter, and that the retort-house operations are conducted throughout with reasonable skill and care. Under such circumstances, it is possible that trouble farther on may cause an inrush of stoppages in the ascension-pipes. It is well known that any obstruction which baffles or hinders the free exit of the gas from the retort—such as tapering ascension-pipes, small dip-pipes or hydraulics, a heavy seal, or a seal in tar instead of liquor—is conducive to these troubles. So it may be that, as soon as a certain rate of production is reached, the current of gas is checked or throttled. The hydraulics themselves, the connections to the foul main, the condensers, or any place between the retort and the exhauster, may be so restricted in area as not to give free passage for the maximum make, though offering no obstruction during the summer and autumn. I have both known and heard of instances where trouble from chokes was always expected as soon as a certain make per day was reached; and also where it was always looked upon as indicating that a deposit of thick tar was accumulating at some point where experience indicated that it was to be expected. Increase of pressure in the purifiers is sometimes responsible for chokes. A systematic investigation with the pressure-gauge will therefore often afford valuable information as to the cause, and will lead, not to "driving to distraction," but to some such simple remedy as clearing out a particular pipe, or running a supply of ammoniacal liquor (usually led from the rising pipe to the scrubber) into a certain length of hydraulic.

Another point that is worthy of consideration is as to the extent to which the methods adopted for clearing the obstruction are responsible for an early reproduction of the difficulty. Frequently it has been remarked that this is confined to particular pipes—perhaps one only out of a setting; the remainder being free. Now does it not happen, and especially so when the "distraction" period has been reached, that every effort is directed to cleaning the pipe and getting it to work again with the utmost possible despatch. The lid is slacked, the top cap is taken off, red-hot bars are introduced to burn a way through the obstruction, and it is encouraged in every way to burn itself out. In desperate cases, red-hot coke is applied externally; or with a good draught a flame may be seen issuing from the top of the pipe, with the result that the mouthpiece and pipe become nearly red hot, and every vestige of soot is burned off the outside. As soon as possible, the pipe is augered or scraped clean—this part of the work being done none too carefully; and the retort is immediately recharged and put to work, regardless of the fact that the conditions which all authorities agree are conducive to chokes, have been exactly produced. The retort has improved in temperature during its enforced idleness; and the mouthpiece and ascension are abnormally hot. The trouble is, therefore, more likely to reappear in the freshly cleaned pipe than in others. A very general remedy is to use a heavy charge of small coal, or to place a shovel or two of wet small coal in the mouthpiece. It is both awkward and unpleasant to take off the offending pipe, and replace it with a new one; the readiness, or otherwise, with which this can be done depending on the arrangement of the joints, &c. Some forms of connection facilitate it; others do not. But when a pipe is plugged from end to end, and at the same time one is pressed for productive capacity, this is the quicker and better remedy to adopt, and will occasionally save a particular retort from getting a bad name.

In addition to this, there is a sort of sympathy between stoppages in the ascension-pipes and accumulation of carbon in the retort; and the conditions which encouraged the one, are also favourable to the other. Though it is not easy to find a theoretical explanation of the effect of a few inches of back-pressure in promoting both chokes in the ascension and deposit of carbon in the retort, it is impossible to dispute the practical evidence that it is a very powerful factor. It is just where the pipes choke frequently that a deposit of carbon comes quickest, and therefore the shorter the intervals between the periods of standing off for cleaning. And at these times there is a reproduction of the conditions first mentioned. The lid is slacked, and the top cap removed, to facilitate the passage of a draught of air up the pipe; and though the primary object is to burn off the carbon in the retort, the current of air is also supposed to be beneficial by cleaning—*i.e.*, burning—off any pitchy or carbonaceous deposit in the mouthpiece and ascension-pipe. We again have the production of an abnormally hot mouthpiece and ascension-pipe, together with a higher temperature in the retort; and unless some additional means are adopted, the newly-cleaned retort is more likely to choke than others. In fact, the conditions are aggravated as compared with those in the former case; for the removal of the carbon from the retort allows a freer convection of heat, and the charge is worked off more rapidly than before. It is a good plan to arrange that the first charge after cleaning should be not only heavier than usual, but allowed a shorter time. But we sometimes find that the first charge is left an hour or two over the usual period, so as to admit of bringing the retort into its accustomed order of working. The men, if left to themselves, will practice many little dodges that appear at first sight to promise a saving of trouble, but which really in the end have a contrary effect.

I have dwelt, with perhaps unnecessary detail, on these little everyday matters, as it is probable that "Country Manager" would prefer some method of working that would enable him to rub along with existing apparatus, rather than details of structural alterations that at best cannot be carried out for some months to come. But a few general considerations as to the environments and working of ascension-pipes may not be out of place. Though the actual surroundings as regards temperature vary perhaps in every pipe, such variation is a matter of degree only. In every case, the pipe is subjected to several influences that tend to raise its temperature, both internally and externally. On the outside, there is heat convected from currents of hot air arising from the furnaces and from flame and smoke during the operations of drawing and charging the retort. There is also radiated heat from the front of the setting, or from adjacent pipes, mouthpieces, or other surfaces hotter than itself. The body of the pipe receives heat conducted from the retort and furnace through the mouthpiece; and internally there is the heat derived from the large volume of gases and vapours escaping from the retort. This is exclusive of heat due to combustion of carbon, either in the retort or the pipe itself, which takes place during cleaning or scurfing the retorts. The causes that tend to lower its temperature are not so numerous—simply conduction to the hydraulic, convection due to currents of colder air, or radiation to bodies colder than itself.

Of these effects, the greatest variation probably takes place in the gases and vapours from the retort, which are largely affected, both as regards quality and quantity, by the conditions of working and the properties of the coal used. Sometimes we are told that larger dip-pipes should be provided. Larger pipes may be of some practical advantage, as leaving a greater margin for deposits; but a pipe 4 inches in diameter, or even less, is quite equal to carrying away the products of distillation as fast as they are evolved. A charge of 3 cwt. of ordinary coal will give off products that eventually take the form of 1500 to 1600 cubic feet of purified gas, 1½ to 2 gallons of ammoniacal liquor, and about the same quantity of tar. The gas, at the temperature at which it leaves the retort, would represent a bulk nearer 3000 cubic feet, the water vapour would represent something like 800 cubic feet, and the tar vapour considerably less, as its specific gravity is much heavier than that of steam. The products from one charge may amount to as much as 4500 cubic feet in bulk, which would be spread over the five or six hours of the charge. Now, according to Newbigging, a short length of 4-inch pipe would pass this quantity in an hour, under a pressure of 1-10th or so. Therefore there is no reason to suppose that, even with the freest working coal, the rapidity of production at any time rises to anything more than a 4-inch pipe can readily carry off; and this being so, where does the advantage of a 6-inch or a 5-inch dip-pipe come in? It is a very common thing, when taking down a set of retort-fittings after a season's work, to find accumulations of hard carbon in the ascension-pipes, occupying half the area or more; and the pipes had evidently been worked for some time in that condition, but failed to afford any evidence of their condition. So it is not easy to see how a 6-inch dip should let the gas off with greater freedom than a 4-inch one would do.

Condensation begins immediately the gas quits the retort, and probably proceeds actively during the passage through the ascension; some of the products being deposited, and others carried forward mechanically. The degree of such condensation will be in proportion to the degree of cooling influence to which the pipe is exposed. It would seem that, as chokes are undoubtedly due to matter deposited from the gas, the way to reduce their liability to them is to reduce the condensation. But all the remedies that have yet been proposed may be divided into two classes. The smaller of these consists of roughly filtering the gas as it leaves the retort—to remove soot, dust, or other suspended matter—by the introduction of baffle plates or gratings in the mouthpiece; and the other, of cooling the ascension-pipe by the application of water externally or internally, or of protecting it from radiated heat. Instead of checking condensation by keeping the pipe warm, they aim at encouraging such action by increasing the cooling influence; and of the two classes, they appear to have been by far the more successful, from which it would appear that very often the cause of a "choke" is not too much condensation, but just the reverse. The appliances which act as filters are always found to take up a considerable amount of dust and soot—in fact, the extra trouble required to keep them clean has been advanced as an objection to their use. From this it would appear that a certain quantity of finely-divided solid matter is carried forward from the retort to the ascension-pipe. Being partly softened by the heat, or charged with tarry matter, it would soon form a ring round the lower part of the ascension. Condensed matters from the upper part, slowly trickling down, and being rendered more and more viscid by the vaporizing of their lighter constituents as they successively reach warmer and warmer surfaces, find a lodgment here, and are retained and baked into hard coke or graphite. But supposing the condensation is increased by additional cooling influences. The deposit trickling down the interior of the ascension-pipe will then not only be more abundant, but more liquid—sufficiently so not only to reach the mouthpiece itself, but also to carry solid particles with it. I

take it that these choke-preventing devices act by conveying down into the mouthpiece the matters that, under other circumstances, would form chokes. Apparatus for effecting this result has the practical advantage of being cheap, easily applied to existing apparatus without stopping the make of gas, and as easily removed if found to be unsuitable.

If this explanation is correct, there is another way to obtain just the same result, which I have known to be successfully applied. A very general experience is that the shortest pipes give the most trouble. I sometimes think that the raising of the hydraulic two or three feet clear of the benches, which was put into practice some years ago, was a double-barrelled improvement. It not only placed the hydraulic itself out of the reach of the heat from the settings, but it necessitated a corresponding elongation of the ascension-pipes. Suppose we have an ascension-pipe 9 feet long, in which troublesome deposits are apt to accumulate, either as hard carbon or, what is worse, that thick gluey mass that should make the fortune of a vendor of patent undetachable cement, with which all gas engineers become acquainted sooner or later—and usually sooner; and that, without making other alteration, the pipe is lengthened to the extent of an additional 6 feet. This added part is exposed to a greater degree of cooling influences than the original; and there will not only be more condensation in it, but the deposited matter will be of a lighter and more fluid character. Is it not possible that this, trickling down upon the pitch, soot, dust, &c., in the lower part of the pipe, and slowly percolating the same, may carry the whole down into the mouthpiece in a soft pitchy condition? It has been observed that the interior of the ascension, when in proper action, should not be dry but moist; and that if from any cause it becomes dry, then accumulation of matter commences. Larger ascension-pipes may to an extent secure the same result. By keeping the current of gases for a longer time in the pipe, they would encourage condensation.

And lastly, a word about the hydraulic main. If the gas is to get away freely, and with as little pulsatory action as possible, there must be a sufficient width on each side of the dip-pipe at the surface of the liquid. There is not only room wanted for the free discharge from the particular pipe itself, but also to allow the free passage of the gas from other dip-pipes towards the outlet. I think the old fashioned cast ⊃ hydraulics were deficient in this respect, and the circular ones were worse. Some of them were about 14 inches each way, and only left a space of about 24 square inches on each side of the dip, through which the gas from, perhaps, 20 or more retorts had to make its way while yet in a heated and expanded state. Even when the plan of breaking up the hydraulic into sections of 12 or 15 retorts on each was adopted, there was none too much room. The gas-outlet should be in the centre of each section, and not at one end. The surface width of the hydraulic should not be less than 18 inches; and it may with advantage be as much as 21 inches, as there are other points to be urged in favour of a wide hydraulic, apart from its allowing free exit from the retort.

The Managership of the Cambridge Gas-Works.—At a meeting of the Directors of the Cambridge University and Town Gas Company last Thursday, applications for the office of Manager, shortly to be vacant by the resignation of Mr. O. J. Weeks, were considered. Out of the numerous candidates, fourteen were selected as the most eligible. This number was subsequently reduced to two; and these gentlemen have been invited to appear before the Board at their next meeting, when one of them will doubtless receive the appointment.

Proposed State Water Commission for New York.—A State Water Commission for New York is proposed in a Bill which has been introduced in the Senate of that State. It provides that the Governor shall appoint three persons, two of them residents of Greater New York, who, with the State Engineer and Secretary of the State Board of Health, shall form a Board, and investigate the whole general subject of water supply for the cities of the State, and the feasibility of State construction of reservoirs and conduits for the supply of water for cities and towns. The Board are to include in their investigations the Adirondack region, Lakes George, Champlain, Ontario, and Erie; and they are authorized to employ engineers and other assistants, and to expend £5000.

Midland Association of Gas Managers.—As briefly announced in the "JOURNAL" last Tuesday, the annual meeting of the Association will be held next Thursday. We now learn, from the circular issued by the Honorary Secretary (Mr. C. Meiklejohn, of Rugby), that the members will assemble at the Grand Hotel, at two o'clock. After the transaction of the usual routine business, including the presentation of the report and accounts, and the election of new members, the President (Mr. John Young, of Etruria) will deliver his Inaugural Address; and Mr. Charles Hunt will contribute a paper "On the Application of Oil for the Production of Illuminating Gas." At the conclusion of the business, the members will be conveyed in brakes to the Windsor Street Gas-Works, where, by the courtesy of the Gas Committee of the Birmingham Corporation, they will be permitted to inspect the water-gas plant of the Merrifield-Westcott-Pearson type recently erected by the Economical Gas Apparatus Construction Company, Limited, and which was described and illustrated in the "JOURNAL" for the 2nd inst.

TECHNICAL RECORD.

THE DENAYROUZE BURNER IN ENGLAND.

Our "Register of Patents" and the public utterances of Professor Vivian B. Lewes have made readers of the "JOURNAL" generally acquainted with the formation of the atmospheric gas-burner devised by M. Denayrouze, and the purpose it is designed to serve. There is an interesting story about the genesis of this burner. We are told that M. Denayrouze—who has been called "the Father of electric lighting in Paris"—could not by electricity light up large spaces or public streets to his satisfaction. He therefore turned his attention to gas; and the burner under notice is the outcome of his investigations. The encouraging results realized by the inventor at the outset, and the unstinted praise of qualified experts, prompted him to pursue his researches; and he has attained, by simplified means, to high efficiency. In the form of burner first introduced to the notice of gas engineers in this country, after the gas and air had mingled in the ordinary way, thorough admixture was obtained by a small fan, driven by a miniature electric motor at a high rate of speed, in a chamber situated at a little below the point of combustion; and more recently advantage was taken of the ascending power of the products of combustion to supply the small amount of energy required for actuating the fan to produce the mixture. M. Denayrouze then discovered the law which is the subject of his present patent; and he is able to get practically the same results, as far as lighting is concerned, with a burner of special form and shape, carefully studied out for different qualities and pressures of gas. The great value of the burner lies in its utility as an auxiliary to the incandescent system of lighting; the complete admixture of the gas and air serving to increase the duty of the mantles.

The patent rights in the burner for Great Britain and Ireland have been purchased by the Denayrouze Light Syndicate, Limited, who have offices in Victoria Street, Westminster. A few days since, a representative of the "JOURNAL" waited upon the General Manager of the Syndicate (Mr. C. E. Masterman, Assoc.M.Inst.C.E.), to learn something as to their proposals in regard to the exploitation of the invention in this country. He was informed that arrangements were being made for the manufacture of the lamps on a large scale by one of the leading engineering firms. Every part is to be made with the exactitude of the works of a watch; so that all portions may be interchangeable, and cheaply renewed. It is not the intention of the Syndicate to put a cheap lamp on the market; but their aim will be to produce a really good scientific "machine," which will get the utmost duty out of the gas, so that every penny spent in gas will produce its full quantum of light, and there will be no emission of unconsumed particles of carbon into the air. Lighting on the large scale—such as the illumination of streets, open spaces, and big interiors—is the direction in which the Syndicate propose at present to compete; and existing systems will find the new-comer a sturdy rival. The light is brilliant and soft; and the burners can be grouped so as to obtain one large solid body of light. No chimneys are required, but a glass shade may surround the whole group; and thus the liability to loss by breakage is lessened. A great point in their favour is that these lights seem able to burn absolutely without any glass covering; but, having regard to the fragility of the mantles, it is advisable, in draughty interiors, to protect them with an ornamental basin or bell-shaped shade. When a chimney is used, a large bulbed one is preferred, so that there may be no current of cold air rushing up against the mantle on the light being extinguished. In Paris the burners have obtained a good footing; and they are largely employed in the cafés and on the boulevards. There no glasses are used; outside lights being simply enclosed in lanterns.

Asked whether he found the increased heat affected the durability of the mantle, Mr. Masterman replied that, on the contrary, it improved it. The reason he gave for this was that the combustion was so exceedingly perfect, that the top portion of the mantle was just as purely incandescent as the bottom or middle part; and the consequence was there was no uneven tension on the particles forming the mantle. One of the lights burning in Mr. Masterman's office bore out his assertion as to the incandescence being complete and uniform. He also produced for inspection a mantle, which, he said, had been burning in the room for 640 hours; and it was certainly remarkably clean and still in good condition. The mantle which was in use at the time of the visit had been running for 90 hours. The former figure is particularly interesting, as the conditions under which the mantle was tried are not conducive to longevity. The room is below the level of the road, and in close proximity to the underground railway, so that the light is subjected to constant and considerable vibration. The Syndicate have a distinct preference for the old form of carrier for the mantles—that is to say, the German silver wire, clamped to the side, which tends, it is believed, to preserve the mantle from shock.

Of the illuminating power of the light it is also possible to speak in high terms. In the course of the conversation, Mr. Masterman ascribed to the light an illuminating power of 150 candles, with 9 feet of gas an hour, at 2½ inches pressure; but since then he has informed us that he has made further tests, and was able to obtain 180-candle power, with a consumption of 9 feet, at

2 inches pressure, which is the highest result he has yet secured at normal pressure.

Questioned as to the proportion of air to gas used in these burners, Mr. Masterman said he understood that M. Denayrouze has made experiments on this point in Paris, and finds his burner draws in 4 parts of air to 1 part of gas, as compared with 3 parts of air to 1 part of gas in the case of the Welsbach burner (the French pattern)—that is, the consumption of gas is one-fifth and one-quarter respectively. M. Denayrouze has also turned his attention to the application of his invention to heating purposes; and he has taken out some patents in France in that respect.

To enable gas engineers and lighting authorities to judge of the remarkable qualities of the light, the Syndicate has an installation of the lamps in one of the galleries of the Royal Aquarium, Westminster. A better place could not have been selected; for there the body of the hall is lit by electric arc lamps, and one is able to grasp, by comparing the two systems, something as to the meaning of the hard-to-define term "illuminating effect." The "effect" is all on the side of the Denayrouze gas-lights—their brilliancy, diffusive quality, and softness being at once striking, in contrast with the dulness and harshness to the eye of the electric light. The Denayrouze installation comprises four clusters of eight lights, each cluster being rated at 1200-candle power; three clusters of five, each of 750-candle power; and eight single lights of 150-candle power. The mantles used are manufactured for the Syndicate by the Incandescent Gas-Light Company; and they are of rather larger size than those supplied for the ordinary system of lighting. All interested in public lighting and the illumination of large interiors should certainly see this exhibition.

THE DEVELOPMENT OF LIGHT FROM GAS-FLAMES.

By Vivian B. Lewes, F.I.C., F.C.S.,
Professor of Chemistry at the Royal Naval College, Greenwich, and Chief Gas Examiner to the Corporation of London.

[A Paper prepared for the Gas Industries Exhibition, New York, and read by the Managing-Director (Mr. E. C. Brown) on the 4th inst.]

The end to be attained by the gas manager of every country is the development of the most effective illumination from the gaseous mixture which he produces; and I conceive that, to an audience composed of men striving for this result, a discussion of the methods by which luminosity is obtained will not be without interest.

It is now just eighty years since Sir Humphry Davy first put forward his theory of the causes which lead to luminosity in flames—a theory which is generally stated as being that the presence of solid particles in the flames is essential to its luminosity. This theory remained unquestioned until Professor E. Frankland, in his celebrated communication to the Royal Society in 1868, showed that, although solid incandescent matter in a flame renders it luminous, luminosity is also, in many cases, produced when the flame contains very dense vapours at a sufficiently high temperature; and also that a non-luminous flame may be rendered luminous by increasing the pressure. This gave rise to a storm of criticism; and the next few years drew forth a rich crop of papers on the subject. Professor Frankland not only showed that flames might be luminous without containing solid particles, but advanced the theory that the luminosity of the flame of a burning gaseous hydrocarbon was due to dense hydrocarbon vapours—pointing out that the soot deposited on any cool substance held in such a flame contained hydrogen. To this W. Stein replied, showing that the deposited soot contained less than 1 per cent. of hydrogen, which was probably, therefore, only occluded by the carbon; and also that if it had been present as a vapour in the flame, it ought, on being heated to the same temperature as the flame, to be once again volatile, which it undoubtedly is not. In 1874, Soret attempted to show that the luminosity of the flame really does depend upon the presence of solid particles, by focussing the sun's rays upon a luminous flame, and examining the reflected light by means of a Nicol prism; and rather later Burch pursued the same lines of research, but employed the spectroscope for his examination of the reflected light. Their results point unmistakably to the presence of solid particles; and at the present time there is very little doubt in anyone's mind that, as far as the flames of candles, oil, and gas are concerned, Sir Humphry Davy's theory is the correct one.

While this war of solid particles *versus* dense vapours was waging, Hilgard, Landolt, Blochmann, and Heumann were trying to trace the chemical actions taking place in various flames, and the causes which led to loss of luminosity when the air was mixed with coal gas before combustion in the bunsen burner. Heumann added the further proof to the solid-particle theory of luminosity, that all flames that owe their luminosity to incandescent solid matter give definite shadows, while those in which luminosity is due to dense vapours give none; and that candle, oil, and gas flames all cause well-defined shadows. The work of Soret, Burch, and Heumann proves beyond doubt that our ordinary illuminating flames contain, in the luminous zone, particles of solid matter; and the only solid which could be present is carbon, either pure or containing the merest trace of hydrogen. The chief question remaining to be solved, consequently, has reference to the action leading to the formation of the solid particles in the luminous zone of the flame.

In the years 1890-91, I made a very large number of experiments, in order to trace the various actions which take place in the interior of a gas-flame, and which culminate in the liberation of the solid carbon particles within it, which, heated to incandescence, endow the flame with its light-giving powers. I found that the non-luminous zone at the bottom of the flame, which the gas manager has always looked upon as one of his worst enemies, is, in reality, the birthplace of the luminosity, as it is here that you have the gradual conversion of the hydrocarbons present in the gas into acetylene, which, in our hydrocarbon flames, is the mother of light. Illuminating gas—whether it be the ordinary coal gas, carburetted water gas, or carburetted fuel gas—is in every case a mixture of many gases, the chief of which are hydrogen, carbon monoxide, methane, and other hydrocarbons, saturated and unsaturated, together with minute traces of carbon dioxide, oxygen, and nitrogen, which the gas manager does all in his power to keep to the lowest limits. This mixture is delivered to the consumer in the gas-pipes, where it is under a pressure which will vary from 1 to 6 inches; and as these gases are allowed to escape from the burner, and find themselves under ordinary atmospheric pressure, at once the power of diffusion with which each gas is endowed comes into play. The constituents of the gas rush to the surface of the flame at a rate which is faster as their densities become less, with the result that the larger proportion of the hydrogen in the flame finds its way to the exterior and burns first; while a certain proportion of the methane soon follows suit, and next in order would come the carbon monoxide and the lighter saturated hydrocarbons. The result of this is that, as the flame burns, you have a gradual weeding out from it of its lighter constituents, while up the centre of the flame the heavy hydrocarbons pass with but little loss, and become baked between the walls of burning hydrogen and methane; this second retorting having the influence of simplifying their composition until, by the time the top of the non-luminous zone is reached, practically the only unsaturated hydrocarbon present is acetylene.

These facts were experimently ascertained by drawing minute portions of the gas from the interior of the flame at different heights, when the conversion of ethylene and other hydrocarbons into acetylene and methane could be readily traced. But this method of experimenting has been severely criticized; it being said that the check to the action of the flame due to the insertion of a tube, no matter how fine, and the distortion of the flame owing to the withdrawal of any of its contents, must invalidate the results obtained. This, however, is an entire mistake; and if the critics would only take the trouble to repeat the laborious experiments by which these facts were ascertained, they would soon find themselves bound to admit the truth of the observations. Some, indeed, of the pure theorists have gone so far as to say that, as the synthesis of acetylene requires the absorption of an enormous amount of energy, it is impossible for it to be formed in the actions going on within the flame. But these gentlemen have failed to explain how it is that the checked combustion of a luminous flame at once gives rise to the escape of acetylene, as when a bunsen catches light at the bottom; or how it was that, until the introduction of calcic carbide, our principal method of making acetylene was to burn a jet of air in an atmosphere of coal gas, and so, by turning the gas-flame inside out, to remove the acetylene produced by its initial combustion before it could be further broken up, with the generation of luminosity.

Acetylene, which is the simplest compound of two atoms of carbon with hydrogen, is decomposed at a bright red heat into its constituents carbon and hydrogen; and it is this decomposition which yields, in all our hydrocarbon flames, the carbon particles which are essential to their luminosity. Having ascertained this point, and made sure of each step in the action, the next factor to be determined was whether the luminosity of the flame was due to the raising of these particles of carbon to incandescence simply by the heat generated by the combustion of the other constituents of the flame gases and by their own final combustion, or whether other and less obvious actions were also aiding in the creation of the incandescence. The fact that most of the unsaturated hydrocarbons in the flame are converted into acetylene before luminosity commences, naturally directs one's attention to this compound; and the fact that it is highly endothermic—*i.e.*, it emits a large amount of heat in its decomposition, instead of absorbing it, as is the case with most compounds—at once suggests the idea that it may be the liberation of heat during its decomposition that endows the carbon particles produced from it with incandescence. Like most endothermic bodies, its decomposition can be effected with great rapidity; and it can be instantaneously resolved into its constituents by firing in the gas, under slight pressure, a detonator containing one-tenth of a gramme of mercuric fulminate. This decomposition is accompanied by a flash of intense white light, which, as no combustion is taking place and the carbon particles are left deposited as a cloud of soot, can only be due to the intense heating of the particles by the heat liberated during decomposition; and this heating will probably be largely due to the endothermic character of the compound, and also partly to the heat which must necessarily be set free in the conversion of carbon from the condition in which it exists in the gaseous molecule to the solid state.

If it is the liberation of heat by means such as these, then if acetylene be passed through a tube heated to the temperature existing in the luminous portion of a hydrocarbon flame, one ought to find that the acetylene decomposes with light without the presence of any oxygen to bring about combustion. That it does so, was proved by experiment. On passing acetylene through a piece of hard Jena glass tubing, and allowing it to burn at the end so that no air could possibly be with the gas in the tube, and then heating 5 or 6 inches of the tube by means of a long flat-flame bunsen, it was found that, as soon as the tube reached a certain temperature, the acetylene decomposed with bright luminosity as it enters the heated zone, and clouds of carbon were seen to pour forward from the point of decomposition. But as these heated particles of carbon passed on through the heated tube, even though their temperature was far above that at the point at which the luminous decomposition took place, they showed no signs of luminosity—indicating clearly that it is the action that leads to their formation, and not the action of temperature on them after formation, which gives their light-emitting power.

I have no desire to overrate the part played by this action in the general luminosity of the flame; and it is perfectly manifest that the power of emitting light must depend upon many actions, all of which give their quota to the general effect. These actions may, I think, be tabulated as follows; their probable importance being in the order in which they are given:—

1.—The conversion of the hydrocarbons in the flame into acetylene, which, by its sudden decomposition on reaching the portion of the flame in which the temperature is sufficiently high to bring it about, localizes the heat of its formation, which is liberated, on decomposition, in the products of its decomposition, and so raises the carbon to incandescence.

2.—The heat produced when the carbon in the gaseous acetylene becomes converted into solid carbon. The amount of heat so liberated is not known; but it must be considerable.

3.—The heating effect of the combustion going on in the outer zone of the flame upon the carbon particles within it.

4.—The heat produced by the combustion of the carbon particles by the combined influence of oxygen, water vapour, and carbon dioxide; the water vapour and carbon dioxide, which are present as products of combustion, playing a far more important part in the ultimate destruction of the carbon particles than the oxygen of the air.

What has been termed the acetylene theory of luminosity, has met with what was, I believe, intended to be severe criticism. But so far, I have not seen or heard one word which shakes my confidence in its truth; and in every case the criticism has been due to the critic not understanding the bearing of the theory. For instance, when it is stated that it is the formation of acetylene in the flame which causes its luminosity, and that the amount of acetylene which does the work in an ordinary gas-flame is only between 1 and 2 per cent., it at once suggests to the ordinary observer that, if this be so, then from 1 to 2 per cent. of acetylene added to a non-luminous flame would give it the same luminosity as the flame before referred to. But it is the presence of acetylene at the point where luminosity commences which is the important factor, and not the presence of acetylene in the initial gas—*e.g.*, if you mix 2 per cent., or even a much larger quantity, of acetylene with a blue water gas, the flame is absolutely non-luminous, and no trace of acetylene can be detected at the height of an inch above the nozzle of the burner; the acetylene present having been converted into other compounds of hydrogen and carbon which burn without decomposition. The important factor to bear in mind is that every compound of carbon and hydrogen requires a definite temperature to decompose it into carbon and hydrogen. If in the combustion of the flame the temperature does not reach this point, no matter how much carbon may be present in the combination, that combination burns with a non-luminous flame. Moreover, it is essential to have the acetylene created at the spot where the temperature is sufficiently high to bring about its immediate decomposition; otherwise, the heat causes it to polymerize into other compounds which burn without decomposition, and so without light. And, lastly, it must be remembered that, before any of these hydrocarbons are decomposed into hydrogen and carbon, with emission of light, they must first be brought down to acetylene—an action which requires a certain definite amount of heat, and which governs the size of the non-luminous zone of the flame.

The temperature at which acetylene decomposes with luminous separation of carbon varies with the degree of dilution; so that, although pure acetylene decomposes with evolution of light at 780° C., each 10 per cent. of dilution necessitates an increase of 100° in temperature of the flame. Therefore, when you have only from 1 to 2 per cent. of acetylene present at the point where luminosity commences, it means that the temperature at that point has to be close upon 1800° C. But given the 2 per cent. of acetylene at this point, and given the requisite temperature, you obtain the luminous effect of practically a 16-candle gas. The fact is that, in order that the acetylene should give its full lighting power in the flame, it must be elaborated in the flame itself, so as to be ready at the point where it is required; otherwise considerable loss takes place during its passage through the space necessary for the flame to get up to the required temperature. It is this that makes enrichers such as benzene of value. If you mix benzene with blue water gas, while the flame is getting to the right temperature the benzene is broken down to acetylene; so that the acetylene and the right temperature are reached at the same time. But if you mix acetylene with water gas, while the flame is getting up its temperature the acetylene is being converted into benzene and other hydrocarbons which, requiring a higher temperature for their decomposition in that highly dilute condition, burn practically without luminosity. From this, it will be manifest that the luminosity of a flame is governed, not by the percentage of acetylene in the original gas, but by the percentage in the gas at the point at which the temperature is sufficiently high to bring about decomposition. If you mix 10 per cent. of acetylene with 90 per cent. of hydrogen, the flame is practically non-luminous; but if you burn the hydrogen at an open jet, and introduce the 10 per cent. of acetylene into the flame an inch above the mouth of the burner, you not only obtain an intensely luminous but a very smoky flame.

Extended experiments have also shown that, with flames of the same size, burning from the same burner, the light emitted is practically proportional to the percentage of acetylene present at the top of the non-luminous zone of the flame; provided always that the temperature is sufficiently high to complete its decomposition. It is perfectly possible for the temperature of the flame to be so little above the point necessary to decompose the diluted acetylene that, while some decomposes and renders the flame faintly luminous, the larger portion burns without decomposition. A good example of this is to be found in the combustion of ordinary spirits of wine, the flame of which contains as much acetylene as is to be found in a good coal-gas flame, but which is practically almost non-luminous; while if the alcohol flame is surrounded by an atmosphere of oxygen instead of air, the temperature of the flame is at once increased, and it not only becomes highly luminous, but will deposit soot upon a cold surface held in it.

Many gases contain within them the power of emitting high luminosity, and yet are looked upon as non-luminous, because the heat required to break up their molecules, and so liberate from them the necessary carbon particles, is so high that under all ordinary conditions they burn without decomposition, and are therefore credited with being non-luminous gases. The compound of carbon and nitrogen which we know as cyanogen—and which contains, for the same volume, as much carbon as acetylene, and an even larger amount of heat of formation—is one which, though celebrated for the beauty of its rose-coloured flame, was never even suspected of being capable of burning and emitting light until, in working out this theory of luminosity it occurred to me to burn cyanogen under conditions in which the temperature of the flame should be sufficiently increased, when it was found that this so-called non-luminous gas emitted as much light as acetylene itself. This was done by burning the cyanogen at a small jet, and surrounding it with a stream of nitrogen dioxide, which, being itself an endothermic compound, gave rise, when burning with the cyanogen, to a flame which emitted the most dazzling light, and also deposited a mixture of soot and para-cyanogen upon a cold surface held in it.

Mr. Wilfrid Irwin read a paper before the Manchester Section of the Society of Chemical Industry in January, 1896,* in which he examines the appearance of a flame after the gas has been passed through a red-hot iron tube. He finds that when the tube through which the gas is flowing is heated to a temperature of between 800° and 900° C., a very slightly luminous flame is obtained from Manchester gas; and this flame consists of several bands. Immediately above the jet is a non-luminous lower layer, then a luminous layer, a non-luminous band above this, an upper luminous layer, and another non-luminous band at the top of the flame. He also finds that when he uses mixtures of hydrogen and benzene and hydrogen and pentane, the luminosity of the gas is destroyed at about the same temperature as with ordinary Manchester gas. In these experiments, the heated tube is playing the same part as the non-luminous zone in the flame; but the mixture produced is burned after having been passed through a glass chamber, in which it is cooled down again. But in the heating, its illuminants were broken up into acetylene, traces of benzene, and other compounds. When these were again heated at the burner, the flame had to get up its temperature by combustion in the ordinary way; the result being that the acetylene produced in the tube was practically all burned without luminosity, while the small trace of benzene also formed there gave the narrow band of light, owing to its being decomposed back to acetylene. This, however, taking place at a lower temperature than the conversion of methane into acetylene with evolution of luminosity, there was a gap in the flame between the first and second luminous bands, which was due to the acetylene formed from the methane; while above this again was a non-luminous zone of combustion formed by the burning of carbon monoxide and hydrogen generated in the flame interactions. Mr. Irwin then does away with the glass tube, and burns his gas hot; and he seems surprised to find that the non-luminous zone is largely decreased, and also that as the temperature in the tube rose, the bands in the flame drew nearer the orifice and finally disappeared—the flame, however, then sparkling with separated particles of carbon issuing from the burner, a result which,

* See "JOURNAL," Vol. LXVII. p. 563.

from the acetylene theory, must ensue. At the time when the luminous zone came back nearly in contact with the orifice of the burner, the heated tube was playing the part of the non-luminous zone; while, with a still higher temperature, the acetylene was decomposed in the tube into carbon and hydrogen, the luminosity of the flame being there destroyed.

Later on in his paper, Mr. Irwin shows how thoroughly he has misunderstood the actions which were to be expected in the flame. He says: "Since a flame produced by burning a mixture of hydrogen and acetylene also exhibits stratification, it is clear that the question of the cause of luminosity cannot admit of the simple solution put forward by Professor Lewes. Here, as in other cases, luminosity is produced by two different reactions, occurring at different levels and at different temperatures; and much more labour will be required before any clear light on the subject is obtained." It is evident from this that Mr. Irwin has missed the whole idea of the acetylene theory, and looks upon acetylene in the gas as the same thing as acetylene produced in the flame. As the mixture of hydrogen and acetylene burns, the heat of the flame brings about several changes. Some of the acetylene polymerizes to benzene, some acetylene combines with hydrogen to form ethylene; and this ethylene again decomposes, under the baking influence of the flame, to acetylene and methane. The acetylene formed in this way, and also formed from benzene, gives him his first zone of luminosity, while the methane formed by the decomposition of the ethylene gives him his upper one; and no other result could take place than that which he considers fatal to the acetylene theory. The next paragraph in his paper shows a still more hopeless condition. He asks: "If the solid carbon theory be a true one, why do not the particles of solid carbon issuing along with the gas from the highly heated pipe yield an illuminating effect equal to, or even greater than, that of the gas when burned in the usual manner?" In writing this, he evidently forgets that if he brings about the decomposition, which yields the light, in his iron tube, he gets the light there, and not in the flame; and the very fact that the products of decomposition do not give light when heated in the flame, is one of the best proofs that could be adduced that it is the decomposition which is chiefly responsible for the generation of the luminosity.

It may be urged that you may take hydrocarbon vapours which contain far more carbon than is necessary for combining with the hydrogen present in the molecule to form acetylene, so that if acetylene is produced free carbon will also be formed; that the light given by such hydrocarbons will, therefore, only be partly due to the decomposition of the acetylene; and that a large proportion of the free carbon there has simply been shed off from the original molecule, without the intermediate step of the conversion into acetylene. That this is so is perfectly true; but any gas manager knows the appearance of such flames as these. If you take the flame of hot gas before the tar vapours have been removed from it, instead of getting a bright white light, due to highly incandescent particles of carbon, you get a heavy, lurid, smoky flame, in which it is manifest that many of the carbon particles are only heated by the combustion of the other gases in the flame. In consequence, the light emitted is of a low order, as the carbon particles are not hot enough to be properly burned up before escaping from the flame.

The description of the various parts of a luminous gas-flame which I am most inclined to adopt, is that it consists of two zones—the outer envelope of combustion, and the inner region of non-combustion. The outer zone is the portion of the flame where the combustible gases present in the original gas, or generated by actions taking place in the inner zone, meet with the air and undergo combustion—forming an envelope of intensely high temperature, but no appreciable luminosity. The maximum combustion takes place towards the inner side of the outer zone, as it is here that the largest proportion of the hot gases meet the oxygen of the air; the diluting and cooling effect produced by the air and products of combustion rapidly causing the external portions of this zone to fall in temperature until finally extinguished. The lower portion of the outer zone is chiefly due to hydrogen and methane, which have diffused out from the coal gas undergoing combustion; while the upper portion of the outer zone is fed by carbon monoxide and hydrogen formed by the decompositions and interactions in the inner zone.

The inner zone is the region into which no oxygen penetrates; and in it many decompositions take place, due to the baking action of the heat generated in the outer zone, and to interaction with the products of combustion. This zone may be subdivided into three parts: (*a*) The non-luminous portion, in which the heavy hydrocarbons flowing upward from the burner rapidly increase in temperature, owing to radiant heat from the outer flame walls, and are converted thereby into acetylene. (*b*) The luminous portion, which is produced by the acetylene formed in the flame being heated to a temperature at which it is decomposed with such rapidity that the particles of carbon liberated are raised to incandescence by the heat generated during their formation; the carbon particles being afterwards consumed by the carbon dioxide and water vapour diffusing into the flame from the outer zone, yielding carbon monoxide and hydrogen, which, together with the hydrogen liberated from the acetylene, give by their combustion the upper portion of the outer zone. This portion of the inner zone will only be formed near the point of maximum temperature, and therefore forms in contact with the outer zone a sheath or cone which caps the non-luminous part. (*c*) The blue region at the base of the flame. This portion of the flame is a continuation of the luminous portion, in which the carbon dioxide and water vapour from the outer zone burn up the hydrocarbons to carbon monoxide and hydrogen before the temperature has risen sufficiently to decompose them into carbon and hydrogen.

The experiments which have occupied me for the last six years, and which have caused me to put forward the above theory of the causes of luminosity in illuminating flames which contain hydrocarbons, also embolden me to offer a few words of respectful criticism on Professor Frankland's classic research. Dr. Frankland, in his celebrated communication made to the Royal Society on June 11, 1868, says: "I found there are many flames possessing a high degree of luminosity which cannot possibly contain solid particles. Thus, the flame of metallic arsenic burning in oxygen emits a remarkably intense white light; and as metallic arsenic volatilizes at 180° C., and its product of combustion—arsenious anhydride—at 218° C., while the temperature of incandescence of solids is at least 500° C., it is obviously impossible here to assume the presence of ignited solid particles in the flame. Again, if carbon disulphide vapour be made to burn in oxygen, or oxygen in carbon disulphide vapour, an almost insupportably brilliant light is the result. Now, fuliginous matter is never present in any part of this flame, and the boiling-point of sulphur—440° C.—is below the temperature of incandescence; so that the assumption of solid particles in the flame is here also inadmissible. If the last experiment be varied by the substitution of nitric oxide gas for oxygen, the result is still the same; and the dazzling light produced by the combustion of these compounds is also so rich in the more refrangible rays, that it has been employed in taking instantaneous photographs, and for exhibiting the phenomena of fluorescence. Many other similar cases of the production of brilliant light from incandescent, gaseous, or vaporous matter might be cited; but I will mention only one other. Among the chemical reactions celebrated for the production of dazzling light, there are few which surpass the active combustion of phosphorus in oxygen. Now, phosphoric anhydride, the product of this combustion, is volatile at a red heat; and it is therefore manifestly impossible that this substance should exist in the solid form at the temperature of the phosphorus flame, which far transcends the melting-point of platinum. For these reasons, I consider that incandescent particles of carbon are not the source of light in gas and candle flames; but that the luminosity of these flames is due to radiations from dense but transparent hydrocarbon vapours." Also: "I have recently extended these experiments to the combustion of jets of hydrogen and carbonic oxide in oxygen under a pressure gradually increasing to 20 atmospheres. These experiments were conducted in a strong iron vessel, furnished with a thick plate of glass of sufficient size to permit of the optical examination of the flame. The appearance of a jet of hydrogen burning in oxygen under the ordinary atmospheric pressure is too well known to need description. On increasing the pressure to 2 atmospheres, the previously feeble luminosity is very visibly augmented; while at 10 atmospheres pressure the light emitted by a jet about 1 inch long is amply sufficient to enable the observer to read a newspaper at a distance of 2 feet from the flame—and this without any reflecting surface behind the flame. Examined by the spectroscope, the spectrum of this flame is bright and perfectly continuous from red to violet. With a higher initial luminosity, the flame of carbonic oxide in oxygen becomes much more luminous at a pressure of 10 atmospheres than a flame of hydrogen of the same size and burning under the same pressure. The spectrum of carbonic oxide burning in air is well known to be continuous; burned in oxygen under a pressure of 14 atmospheres, the spectrum of the flame is very brilliant, and perfectly continuous."

These objections are of the greatest weight. But researches of Stein and others showed undoubtedly that they were erroneous as regards the cause of luminosity in hydrocarbon flames; and I certainly consider that the facts which I have brought forward entirely dispose of the possibility of the luminosity of hydrocarbon flames being due to incandescent vapours. To my mind, the experiments made by Dr. Frankland with hydrogen and carbon monoxide burning in oxygen are by far the most important of the objections which he has raised. Inasmuch as a flame consists of gaseous matter, pressure will act upon it in the same way that it will act upon a gas. By increasing the pressure, you therefore diminish the size of the flame; or if you keep the flame a constant size, you consume within that area an increased volume of gas. This being so, it is manifest that the temperature of the flame of hydrogen and oxygen burning under pressure may be enormously great; and there is no reason to suppose that at such temperatures as would be obtained under these circumstances the steam generated by the combustion of the hydrogen and oxygen, or even the gases themselves, might not become luminous, as the temperature would be far above any which could be experimentally tried upon water vapour. The fact that water vapour dissociates at temperatures far short of any such point, will not interfere in this case; and if no hydrogen is found free in the products of combustion, the action must be finished in the flame itself. Under these conditions, carbon monoxide gives far more luminosity than hydrogen; and I know of no proof that, at the temperatures which would be produced by the combustion under pressure of carbon monoxide

in oxygen, some of the carbon monoxide at least may not be dissociated. Indeed, one would rather expect such to be the case; and no matter how brief the period of liberation, it would be quite sufficient to account for the light emitted.

In the other cases adduced by Dr. Frankland, I think the whole evidence is in favour of the solid particle theory. If we take carbon bisulphide and burn its vapour in air, a non-luminous flame is produced, because the temperature is not sufficient to bring about the decomposition of the bisulphide molecule, and so it is consumed as a whole and without any liberation of carbon particles. But if the vapour be burned in oxygen, and the products of combustion removed with sufficient rapidity, a very highly luminous flame is produced; and if this be examined closely, it is seen that the most luminous portion is a thin band immediately below the inner cone, which undoubtedly presents an appearance of luminosity due to the liberation of carbon particles in a high state of incandescence. And when one comes to consider that carbon bisulphide is endothermic, one realizes that the probabilities at least are strongly in favour of it being the localization of the heat of formation of the carbon bisulphide in the carbon particles during the enormously rapid decomposition of some of its vapour, that causes luminosity. We know that, when carbon bisulphide vapour is mixed with nitric oxide, and the mixture ignited, we get a flash of light of the most intense brilliancy, the actinic properties of which are well known, and which point to an excessively high condition of incandescence. In this experiment, we know that before combustion takes place, nitric oxide must be decomposed into nitrogen and oxygen; and inasmuch as the heat of the formation of nitric oxide is 21,575, this means a very high temperature, while the high endothermic value of the bisulphide will again give rise to a great increment of temperature, so that we should expect, *a priori*, incandescence of a very high order. If a mixture of the bisulphide vapour and the nitric oxide be ignited in a short glass jar, the combustion takes place with the emission of brilliant light; but if a long cylinder be used for the experiment, the mixture flashes the first few inches, while true detonation is produced in the lower portion of the jar, and generally blows the whole cylinder to pieces—showing how intense the production of temperature must be.

When phosphorus and arsenic are burned in oxygen, the heat of combination in each case is excessively high—being 154,670 for the formation of arsenious oxide, and 369,900 for phosphorus pentoxide; and it has been urged that it is impossible that any solid particles could be present, as the products of combustion would be vapours at the temperature produced by the combination. But it seems to me that, this being so, you must have the combination to produce the temperature before the temperature can volatilize the products of combustion. Accordingly the solid particles of phosphorus pentoxide must be produced before the heat of their production can act; and no matter how instantaneous the existence of the solid, it is quite sufficient for it to emit a brilliant flash of light. If phosphorus be burned in oxygen, it will be noticed that the luminosity is emitted close to the burning substance, while a big flame of very low luminosity plays above the burning matter, and often nearly fills the jar; and I should certainly imagine that the high incandescence is due to the instantaneous heating of the solid at the moment of combination, while the lambent flame consists of heated vapour products.

THE DECOMPOSITION OF HYDROCARBONS BY HEAT.

(*Continued from p.* 350.)

II.—*Gas Analysis.*

The apparatus used was the Bunte burette, which, in practised hands, is the most exact and convenient for analyses over water. Its great advantages are the absence of rubber connections and troublesome spaces, and the possibility of employing as small a quantity of any reagent as may be desired.

For the oxygen determinations, the Bunte burette, in conjunction with the Hempel phosphorus pipette, was employed. This was used because, with gases which certainly contain oxygen, a conclusion could be drawn as to the presence of constituents (olefines) which would hinder its absorption by phosphorus; and also because the last traces of oxygen are more easily and exactly removed by phosphorus than by pyrogallol solution. In the work described subsequently, the Bunte burette was used for absorption determinations and fractional combustions; but the estimation of hydrocarbons in the residual gas was carried out over mercury, for the sake of greater precision. The Pettersson-Drehschmidt apparatus was employed for these estimations.

The results of combustion over mercury showed that the so-called higher paraffins of the residual gas are not wholly paraffins. For example, in the combustion of a mixture of paraffins and hydrogen, if C = the contraction on combustion, K = the carbonic acid formed, V = the oxygen used in the combustion, x = the quantity of oxygen used in the combustion of the volume of the mixture of hydrocarbons which yields 1 c.c. of carbonic acid, a = the average number of carbon atoms in the molecule of the hydrocarbons, and H = the hydrogen, then—

$$(1)\quad \frac{2\left(C + K - x\,K - \frac{K}{a}\right)}{3} = H$$

$$(2)\quad 2\,(V - x\,K) = H$$

$$(3)\quad a\,x = 1{\cdot}5\,a + 0{\cdot}5$$

Equation (3) will be understood by considering the relation of a to x in the case of the olefines, the general formula of which is $n(CH_2)$. Each group CH_2 yields 1 part of carbonic acid, and uses up 1·5 parts of oxygen, therefore—

$$(4)\quad x = 1{\cdot}5 \text{ and} \qquad (5)\quad a\,x = 1{\cdot}5\,a$$

A paraffin differs from the analogous olefine by 1 H_2. Therefore for every paraffin we have (3) $a\,x = 1{\cdot}5\,a + 0{\cdot}5$. Hence—

$$(6)\quad a = \frac{0{\cdot}5}{x - 1{\cdot}5} \text{ and}$$

$$(7)\quad H = \frac{2\,(C + K - x\,K - 2\,x\,K + 3\,K)}{3} = \frac{2\,(C + 4\,K - 3\,x\,K)}{3}$$

But by (2) $H = 2\,(V - x\,K)$. Therefore—

$$(8)\quad 3\,V - 3\,x\,K = C + 4\,K - 3\,x\,K \text{ and}$$

$$(9)\quad 3V = C + 4\,K$$

That is, in all mixtures having only paraffins and hydrogen as combustible constituents, the contraction *plus* four times the carbonic acid is equal to three times the oxygen used up.

By similar reasoning, we arrive at the equation—

$$(10)\quad 3\,V = C + 4\,K - \frac{K}{a} \text{ for a mixture of hydrogen and}$$

olefines. Therefore, in a gaseous mixture of which the combustible constituents are hydrogen, paraffins, and some olefines, the contraction, *plus* four times the carbonic acid, will be greater than three times the oxygen used up. Similarly, for the acetylene series, we arrive at the equation—

$$(11)\quad 3\,V = C + 4\,K - \frac{K}{2\,a}$$

These equations (9), (10), and (11) show that there is a characteristic difference between the paraffins and all hydrocarbons poorer in hydrogen, which enables the presence of other hydrocarbons to be detected in a mixture of hydrogen with methane and its homologues, without recourse to methods of separation by absorption.

It is clear also, from equation (9), that we cannot calculate the composition of a mixture of homologues of methane and hydrogen if only the contraction, the oxygen used up, and the carbon dioxide formed are known; as either no mixture of hydrogen and paraffins, or a great number corresponding to those three numbers, may be found. It is still necessary to know one value independently of the above. Such a value cannot be arrived at from the combustion, as though thence we may obtain, besides the three values already stated, the volume of the combustible gases and that of the aqueous vapour formed, these do not satisfy one possible composition for the mixture to the exclusion of others. The necessary independent factor is most simply obtained from the fractional combustion of the hydrogen. Another method described by Lewes has not had its exactness sufficiently proved; and the principles on which it rests are too weak for it to be used without further proof. It rests on the assumption that paraffin oil removes from a mixture of hydrogen and paraffins the whole of the higher paraffins and some methane, but no hydrogen. On exploding the gas which has been treated with paraffin oil, the carbon dioxide formed is derived wholly from the methane; and the hydrogen may be deduced at once. On exploding the gas without preliminary treatment with paraffin oil, the result can be calculated, as the hydrogen is known from the first experiment. In the cases of both fractional combustion and the Lewes process, naturally only the volume and the degree of condensation of the paraffins can be learnt; and the individual components of the mixture cannot be deduced therefrom.

It was particularly necessary to know how ethylene acts towards bromine, as if the absorption of ethylene by bromine is incomplete, and ethylene is present in the residual gas, the ratio $3\,V : 4\,K + C$ will differ from 1. This question was in other respects very important, as if bromine was found not to absorb ethylene quantitatively, an exact analysis of such gases appeared impossible. Fuming sulphuric acid—which might be used in place of bromine, according to Engler's observation, which has been confirmed—absorbs mechanically a considerable quantity of higher paraffins, and therefore introduces an error into the analyses of such gases. Statements differ as to the behaviour of ethylene; and Winkler has thrown doubt on the quantitative nature of the bromine absorption. It seems doubtful whether his researches were made on pure ethylene, as by the method of preparation from alcohol and sulphuric acid which he used, there is a probability that the gas contained ether. Ethylene was therefore made by moistening zinc dust with alcohol, and allowing a mixture of 80 parts of ethylene bromide and 20 parts of alcohol to drop on to the heated mass. The gas was washed with olive oil, and then treated with a solution of potash and water. Ethylene thus prepared was absorbed quantitatively by bromine. Identical results were obtained with bromine and with fuming sulphuric acid on the gas itself, and on a mixture of the gas with air. The same result was secured whether strong or half-saturated bromine water or bromine vapour was used. Winkler's presumption that bromine does not completely absorb ethylene, is therefore incorrect.

It seemed desirable, at the same time, to investigate the

action of bromine on benzene vapour, as authorities differed as to whether the absorption of that hydrocarbon was a complete one; and in any case it was doubtful whether the benzene was brominated, or whether it was merely mechanically carried down with the bromine vapour. It was proved that agitation of benzene vapour for two minutes in diffused light, with bromine water of known strength, did not alter the bromine content of the latter. A method of determining the amount of bromine used up in the absorption of ethylene and similar hydrocarbons, by titrating the bromine water with thiosulphate and potassium iodide, was carefully elaborated for use with the Bunte burette. Blank experiments were made on known mixtures of air and ethylene, which were simultaneously examined by the titration method and by means of bromine and solution of potash; and the accuracy of the titration method, as elaborated by the authors, was completely established.

Briefly, the method is as follows: A half-saturated solution of bromine is prepared, and a *large* vessel filled with it, so that the loss of bromine when the vessel is opened is small compared with the total quantity in the solution. The strength of this solution is ascertained by titration with thiosulphate and potassium iodide, before and after each analysis in which it is used. The capacity of the space between the lowest mark on a Bunte burette and the lower stopcock is ascertained. About 90 c.c. of the gas to be tested is brought into the burette, and its volume is read off. The water is afterwards aspirated from the burette, and a few minutes are allowed for the walls of the burette to drain; and the drop of water which thereby collects above the stopcock is then carefully drawn out. From 10 to 15 c.c. of the bromine water is next admitted by the lower stopcock, and its level is read off; and then a little water is admitted, to wash the bromine water from the capillary into the burette. The burette is agitated for two or three minutes. Some strong solution of potassium iodide is then admitted, and the contents of the burette are washed without loss into a beaker; and the amount of iodine liberated is ascertained by titration with standard solution of thiosulphate. The mean of the determinations of the bromine water before and after this test is taken; and the bromine absorbed by the gas in the burette is calculated by difference. This method applied to mixtures of air and benzene vapour, showed no loss of bromine, though the ordinary use in the burette of bromine water and solution of potash showed a diminution of the volume of the gas due to the scrubbing down of the benzene vapour. The question of how fully the benzene vapour is thus removed was not pursued, as in the researches the benzene was first removed by paraffin oil.

The determination of the mean molecular weight was carried out in the same manner as in the earlier researches already referred to. Experiments described later on acetylene, rendered quantitative separations of acetylene, ethylene, and small quantities of carbonic oxide necessary. The analysis was carried out over mercury. Carbonic acid was first removed by solution of potash; and then acetylene was absorbed by ammoniacal solution of silver. Silver solution of known strength was used in quantity slightly in excess of that necessary for the formation of the silver acetylide, as ascertained from a rough preliminary test. The gas was deprived of ammonia by dilute sulphuric acid, then measured, and an aliquot part was passed over a small quantity of ammoniacal solution of cuprous chloride. Formation of fine red flakes of copper acetylide betrayed the slightest degree of incompleteness of the absorption of acetylene. Carbonic acid, acetylene, and ethylene together, and carbonic oxide, were determined with a solution of potash, bromine water, and cuprous chloride in the ordinary manner, on another sample of the gas. In many cases, acetylene may be determined along with olefines by the method of titration just described.

(*To be continued.*)

The Generation of Motive Power with Blast-Furnace Gases.—Mr. Walter Dixon and Mr. B. H. Thwaite have recently carried out experiments on the utilization of blast-furnace gases for the generation of power, and for some time past an electric installation at the works of the Glasgow Iron and Steel Company, at Wishaw, has been successfully driven by a gas-engine using these gases at an expenditure of 78·54 cubic feet per indicated horse power, or 105 cubic feet per actual horse power per hour.

Manchester District Institution of Gas Engineers.—The twenty-seventh annual meeting of the Institution is to be held in the Grand Hotel, Manchester, next Saturday. According to the circular issued by the Honorary Secretary (Mr. S. S. Mellor, of Northwich), the members will meet at eleven o'clock, and will proceed first to the electricity generating station and then to the hydraulic station of the Manchester Corporation, permission to inspect which has been granted by the Gas and Water Committees. After luncheon, the business of the meeting will be transacted. Six new members will be proposed for admission; the Committee will present their report and the accounts; and the office-bearers for the year will be elected. The retiring President (Mr. Isaac Carr, Assoc.M.Inst.C.E., of Widnes) will introduce his successor, Mr. Robert Porter, of Elland, who will deliver his Inaugural Address; and Mr. J. Wilkinson, F.C.S., of Drighlington, will contribute a paper entitled "Does the Manufacture of Sulphate of Ammonia Pay in Small Works?"—a very opportune subject for consideration by the members,

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

We conclude to-day our report of the proceedings at the general meeting of the above Association, held at the Westminster Palace Hotel last Saturday week, by giving an epitome of the paper read by Mr. W. Watts (Oldham) and of the discussion which ensued.

DRAINAGE AREAS, STORAGE CAPACITY, AND COMPENSATION WATER DISCHARGED FROM CATCHMENT RESERVOIRS.

The author introduced his subject with some general remarks, and explained at the outset that the object of his paper was to consider some of the difficulties met with by water authorities in undertaking works by administration or otherwise, and the opposition met with in general. Gravitation water-works were in the main referred to; but what was said in reference to the purchase of property, material, &c., had, he said, a wider application. He did not claim to advance anything new; simply contenting himself by alluding to, and drawing conclusions from, cases which had come under his observation during a long series of years. He then went on to point out that drainage areas, for the domestic supply of water to large towns, are selected for their freedom from known sources of contamination, their elevation to provide the necessary pressure, and the quantity and quality of water they yield. Distant watersheds should be large enough to justify the outlay incurred in conveying the water; but they had no right to be greatly out of proportion to the requirements of the people constituting the corporate body, simply because they were rich enough to bear the cost and to anticipate their wants for an unlimited time. Where huge schemes of water-works had been established for the domestic supply of a city or town, and the consumption had not reached the limit of expectation, clauses should be inserted in the Act of Parliament entitling neighbouring towns—on the principle of co-partnership—to a share of the water passing to waste at the head of the works. He acknowledged that such partnerships would be difficult of adjustment. Each town should, he considered, be made to share in the responsibilities of the undertaking, and pay interest on the capital invested in the works, to the extent of the quantity of water taken. Other and more equitable modes of adjustment might be devised; but no claims should be considered without satisfactory compensation being allowed. In semi-national works, such as those of Manchester, Liverpool, Birmingham, and Glasgow, it would perhaps be better if some arrangements could be made by which all parties could be benefited on a common basis and on united responsibilities. But conflicting interests came in; and each local authority liked to have the management of its own affairs, even in small matters. Whether a Water Board appointed on the lines suggested by Mr. De Rance at the annual meeting of the Association last July would be able to satisfy the wants and aspirations of all parties, was doubtful; for local control of municipal affairs was a pronounced feeling in the human mind.

With regard to drainage areas, the author showed that they are regarded as rich in proportion to the amount of rain falling upon them. The physical features of the ground, however, have no little to do in determining the amount of rainfall which it is possible to collect and utilize for the benefit of works constructed to secure it. It is pretty well known that an increase of rainfall is not expected after an altitude of 3000 feet is attained, and that the most prolific feeding-ground is from 1000 feet upwards to the higher altitude. The rate at which the rainfall flows off the watershed into the streams and rivulets draining it depends first on the amount of downpour, next on the inclination of the slopes, and lastly on the character of the sub-strata and seasonable changes. When rain falls on saturated ground, the streams are sooner flooded than when the soil is dry and parched, as in dry weather. The time required for floods to reach their maximum depends upon the nature of the ground, the extent of the watershed, and the downpour of rain. The raindrops make the rivers, and the rivers flow along the valleys. The agencies which have formed them are beyond the control of man; and he is entitled to no other benefits than those of the labour and capital invested in his estate, whether it is required for water-works purposes or not. The water flows on to the sea; and in this primitive condition it possesses a normal value only. But when it is required by a water authority, the value of the estate in which the rivulets exist rises immensely, and the people who create the excess in value are charged an exorbitant price for what they have produced. When a man is compelled to sell his property, he is entitled, in the author's opinion, to generous consideration at the hands of the purchaser; but the law should step in and decide what is fair, and not the caprice of a few individuals, some of whom know very little about the business. There is a sense of right dealing in everything, whether the purchaser be a corporation or a private individual. One sometimes hears the expression that "corporations are made to be fleeced." The idea is low, whether applied collectively or individually. Many honourable people do not think they have been exacting when insisting on being paid more than a fair market price for what they sell to a Corporation. A similar feeling influences juries in the Law Courts; and in cases of arbitrations, umpires lean to the individual side as the weaker factor in the case. A similar feeling, in another form, permeates

working men engaged on public works. They feel that a corporation has plenty to pay with, and that, if the ratepayers at large were canvassed, the vote would be in favour of a generous wage for a reasonable day's work. Thus it is that on all sides the utmost conditions are exacted; the principle apparently being that it is no sin to get what is possible where there is an abundance, and where no individual suffering is inflicted. The desire to extort money from a corporate body needs suppressing by legal or other means. The time-worn statement is crumbling to pieces that corporations cannot execute their own works as cheaply as a contractor. Notwithstanding what has been said about workmen wishing to benefit by disposing of their labour to a corporation, the majority of them work more willingly for a corporate body than for an individual; for the simple reason that the labour is more regular and constant, and, in piecework in particular, the men are more sure to get paid according to agreement. The author is speaking from experience gained on works executed by administration; and while he recognizes the fact that there are many most excellent contractors who care for their men and do justly to them in all things, there are others whom the better class will not serve if they can help.

Passing to the subject of the collection and storage of water, the author remarked that some drainage areas are considerably richer in their supplies of water than others, though the annual rainfall is no greater. Where a large number of rivulets exist, the rain gets away more freely; and besides the geological formations, the slope and contour of the ground, as well as its cultivation, are matters of great importance in determining the amount of rain available from a given watershed. Though it is known that considerable variation in the yield of water from moorland districts is an undisputed fact, custom has determined that the amount of compensation water to be given to the stream from hydraulic works shall be one-third of the available annual rainfall and two-thirds for impounding purposes. The actual measured results are in many cases unknown, except inferentially; and in the early history of gravitation works more water was given to compensate the stream than could be afforded, and it had to be purchased back from the riparian owners. No corporation should be under a legal obligation to compensate a stream on the amount of rain falling on the earth, but on that which can be collected and stored.

Every system of gravitation works to be made efficient depends upon the amount of storage room provided; and every water company should be under an obligation to provide ample storage to deal with all the water it is possible to collect from its appropriated drainage area, except in very extraordinary periods of rainfall, which come only at rare intervals. When the average rainfall is known, there is no reason why the capacity of the reservoirs should not be made sufficiently ample to deal with it without endangering the stability of the work. There are many reasons why this should be done; foremost of all being economy and efficiency of the works. Owing to the expansion of the sides of the valleys in which the reservoirs are made, the upper few feet of the sheet of water contains more space by a great deal than the same depth nearer the bottom; and it may be fairly assumed that it costs very little more to make an embankment watertight at 70 feet than at 50 feet, while the increased storage may be doubled by adding a slight increase of pressure only.

In the construction of all reservoir embankments, the greatest cost is incurred in the foundation of the trenches and discharge tunnels; and as these works are so much more costly in proportion to the rest, the most should be made of them when it is known that impervious strata have been reached. It would be foolish to run any risk in raising the water-level higher than the foundations and material of which the embankment is made, will allow. But experience brings wisdom; and no man who understands his profession would run any risk in work of such vital importance. Where any doubt exists, it is much better to make two shallow reservoirs than one deep one which will not hold water. It has always seemed strange to the author that the depth of reservoirs in general is determined before the character of the geological strata is known, or when it is merely assumed, and that, whether the ground turns out good or bad, the limit of the top water-level is fixed by law, allowing a range of 5 feet only. Where the ground and material for structural purposes are good, and storage is an important factor, discretionary power beyond this limit in vertical height should be placed in the hands of the engineer to enlarge his works without having to obtain additional statutory powers and incurring considerable cost and delay.

The author next went on to show that, when seeking powers to construct hydraulic works on a large scale, the methods of dealing with rainfall require very serious consideration. He pointed out that one-sixth of that which falls on the drainage is allowed for flood loss, regardless of the physical features of the ground and the rate at which the floods are discharged from it. The proverbial one-sixth depends on the storage capacity of the reservoirs and the arrangements made to deal with the floods when they come, and also on the consideration whether the watershed is too large for the town. If the water cannot be utilized, it must flow to waste; but where the two are equally balanced, the flood need not be so great as one-sixth if the reservoirs are made large enough to store the rainfall. In many works known to the author, the storage is too limited; and the consequence is that in dry weather the town is placed on a restricted supply. The amount of storage is an important factor; and in this respect there are scarcely two watersheds alike. The loss from evaporation is necessarily a variable quantity, and depends in a great measure on the nature of the watershed, the subsoil, the character of the vegetation growing in it, and the lie of the streams. It is difficult to say what the amount of loss is from the surface of the land. It must fall short of the amount measured on the surface of water, and consequently represents so much more to the credit of the works. Water-works engineers, knowing the storage capacity of their reservoirs and the number of acres draining into them, by observing the rainfall will be convinced that the average annual amount of evaporation is not so great on the whole drainage area as the gauges register when placed on the lawn near to one's house. Evaporation, however, is an important factor not to be lost sight of in estimating the amount of available rainfall from any given drainage area. Usually it is most in March, April, May, and June, after the rainy season is over and the reservoirs are filled; so that its effects are felt, in the main, on the surface of the water only, except what little the soil and vegetation part with. The importance of making compensation reservoirs large is understood when it is borne in mind that they are, or should be, the receptacles for the floods and for the distribution of one-third of the available rainfall of the drainage.

With regard to mountain sources of water supply, the author emphasized the necessity for carefully selecting them in wet seasons, and for storing the water some time before using it, for domestic purposes. Good circulation also is important to keep it pure, and the lower layers should not be neglected too long, lest they become odorous. To ensure efficient circulation, the quantity flowing in should correspond, as near as possible, with that flowing out; and all water for domestic use should be drawn off near the surface. The lower valves should be used freely when there is water to spare in wet seasons. Peaty water is discoloured, and appears more objectionable in bulk than in the streams; but aëration has a wonderfully bleaching effect upon it. The author said he was convinced that draining the peat beds would have a most salutary effect in ridding this vegetable matter of its acidity, and its consequent action on lead piping. No one would, he thought, question the advantage of getting the water off the land as soon as possible, owing to its solvent properties acting on decayed vegetable matter in particular. Extensive draining means providing ample storage to retain the water which would pass off the ground more quickly. Such water would be chemically more pure, and less liable to produce lead-poisoning; and the loss from evaporation would be reduced. The collection is more important than the distribution of water, if it must be delivered practically free from organic matter. In the author's opinion, the moorland valleys and streams have not received the attention they deserve by water companies, except so far as purchasing existing property to prevent pollution by manuring the land; and this desire has been forced to the front within recent years. Purification should begin on the moors, so as to entail less work on the filter-beds and guarantee a purer water.

The author maintains that, when the consumption is moderately great, 70,000 cubic feet of storage per acre of drainage area should be provided in districts where the average annual rainfall amounts to 45 inches. To thoroughly utilize the rainfall, the consumption in the town needs to be well proportioned, and the flood water carefully looked after. Arbitrary rules, however, should be laid down with caution and founded on experience, or they become dogmatic. There may be years when the rainfall is insufficient to fill the reservoirs, but wet years will see them overflowing; and the seasons must be taken for what they yield on an average. The position of the reservoirs in a valley for collecting and storing water, in order to obtain the highest efficiency of the works, is an important matter. For decanting purposes, reservoirs placed one above another offer the best advantages; the higher ones being reserved for flood water only. To utilize the rainfall is an imperative duty of every water-works company; and the works should be made large enough at the outset for the purpose. The stipulated amount of compensation has to be given whether the rainfall is disposed of by the town or not. If the reservoirs cannot possibly be made large enough to control the water flowing from the drainage area, less compensation water should be given than is measured out in districts where the whole of it is consumed. The fraction of an inch on the total drainage area is an increment of value in favour of the town, and should not be withheld from it in favour of the stream, when the latter is already supplied with the statutory flow. A scarcity of water is sometimes attributed to the poverty of the watershed, when the fault really lies in a want of storage.

Coming to the question of compensation water, the author referred to a series of articles published in Vol. LXII., of "Engineering," in which, he said, the discharge of compensation water by water-works companies was intelligently dealt with by a gentleman who had had a wide experience of watersheds and the delivery of water from those appropriated for domestic use. He seemed to take a gloomy view of the intermittent streams; and complained of the deposition of mud in them—overlooking the fact that intermittent supplies are twice as great as those discharging a continuous flow, and consequently more likely to keep a greater surface of the river clear of mud or

other foul refuse poured into it during the dry-weather periods. The author pointed out that the amount of compensation water is a fixed quantity, and it is practically of no importance to the water companies how it is delivered. A preference doubtless would be given to the constant delivery as involving less supervision on the part of the companies supplying it; but in all matters relating to the mode of furnishing the water the millowners are invariably consulted, and the hours arranged to suit the greatest interest of all concerned. In the author's opinion, it is better for the millowners to have an intermittent flow.

There is no stream in Lancashire immediately below a large system of hydraulic works discharging compensation water where the millowners would resort to the old condition of fluctuating streams if they had the option. The water is more reliable for manufacturing purposes, and purer in quality; and there is more of it in summer time, when it is most needed. Floods are less frequent, and damage to property and inundation of land are of rare occurrence. In not a few cases, millowners have filled up their old dams, and converted them into building land. The distribution of one-third of the available rainfall from a large drainage area on 307 days in the year, during twelve hours of the day, must make the stream more valuable to every manufacturing concern depending upon it for a supply of water. Floods soon pass by when they come, and do very little good beyond scouring the stream. It is pretty well known that the dry-weather flow is about 800 times less than in flood time. The author has gauged streams in a drought producing in one case 13 cubic feet, and in another case 18 cubic feet per minute, which have had allowed them on completion of the works 168 and 253 cubic feet per minute respectively on 67 hours in the six working days. In many cases, manufacturers declare how much their property has been increased in value by the establishment of corporation reservoirs in the higher reaches of the valleys in which their works are situated.

In the matter of compensation water generally, the riparian proprietors have the best of the bargain, and are benefited more than cottage property owners or the urban authorities. A millowner having a dam can pen back the water from his neighbour below, and use it to suit his own convenience; but if a corporation withholds it for ever so short a time, complaints are made and claims for damages are threatened. As a body opposing a water company, the riparian owners have exercised great influence over Parliamentary Committees taking evidence in favour of Bills. They are practically the only organized bodies; and, in consequence, they have been the only bodies heard, while the silent owners have not always participated in the same benefits, though equally entitled on moral grounds to do so. The demands of each stream require to be more particularly defined by law, so that everyone knows what to expect beforehand on the establishment of hydraulic works in the district. In some cases, more compensation water has been given than the works could afford, and has had to be bought back again from the riparian owners. If more has been given, on the basis of one-third of the available rainfall of the district, it should be restored to the works without any payment whatever. One wonders how the money can be equitably divided, or what becomes of it. The works supplying the water to the stream create the value, and all moneys paid for a reduced flow of compensation water should, in the author's opinion, go towards repairing the stream, roads, or bridges in the immediate district. But when an excess has been given in ignorance of the amount of rainfall the watershed produces, it should be recoverable by the company owning the works producing the necessary records to an authority such as that shadowed forth by Mr. De Rance.

In closing his paper, the author expressed the opinion that rivers may be made more valuable than they are by utilizing the rainfall when it comes, storing it in reservoirs, and allowing it to flow out in times of drought. He remarked that there are few valleys where storage room is not available for this purpose. The selection of the sites need not be so carefully made as in the case of those required for domestic supply, nor need the contingencies be so elaborate. Strength and safety are required all the same; and provision should be made for the detrital matter brought down in time of floods.

Discussion.

The PRESIDENT said he was not at one with the author in regard to his views on the question of corporation *versus* contract work. People employed by corporations had an interest in keeping the work on as long as possible. His own experience was that, provided specifications were properly drawn out, a contractor would do the work as good as, and more expeditiously than, a corporation. The contractor had the necessary plant; whereas a corporation had to buy plant, and, at the end of the work, had to sell it for almost nothing. There seemed to be a little inconsistency in Mr. Watts's argument; for, in another part of his paper, he said that workmen engaged on corporation work were more exacting in their claims. That was one of his (the President's) contentions—that they could not expect people to work for corporations without taking the utmost out of them that they could. He also asked for expressions of opinion as to the usefulness as scavengers of fish in reservoirs.

Mr. J. A. PASKIN (Halifax) said the author had alluded to the formation of a sort of joint-stock company by a large town taking into partnership small towns on its line of aqueduct. This had been practically done by the Thirlmere Act, which gave towns along the aqueduct power to take water from the nearest point, paying for it the cost price at that point. As to the discontinuance of the supply, this would depend entirely upon the agreement. No town would make an agreement for a certain number of years; it would be in perpetuity. As to people putting a big value on land required for water-works purposes, provision was made against this by arbitration. As to compensation, one-third of the rainfall was correct in Lancashire and Yorkshire, where most of the gravitation works were; but it was not universal. The available rainfall in Mr. Watts's district and his own was about 27 inches—the fall was 45 inches, and about 18 inches was lost in evaporation and absorption. In the parliamentary proceedings in connection with the Thirlmere scheme, the rainfall was estimated to be 90 inches. The opposition said they wanted one-third of that; but the other side said "No, you can have 9 inches," and that was what they had. The "one-third" happened to be right when the available rainfall was 27 inches. As to the preliminary work connected with the construction of reservoirs, he expressed a preference for trial-holes rather than bore-holes, because with the former one could get down and really ascertain the nature of the strata, whereas with the latter they might pass through a big stone, and have a return of rock. Reverting to the question of compensation water, he said that a continuous flow was certainly advantageous to the riparian owner, and was more convenient to the person in charge of the reservoir, because he had not to open or shut the valves overnight. He agreed with the President as to employing a contractor to carry out works, *if* he really was a good man. But unfortunately corporations had a habit of accepting the lowest tender; and an engineer could not compel a contractor to do the work if he had nothing to go on with. He believed that fish in reservoirs were very beneficial; but they must not be allowed to increase too rapidly.

Mr. W. G. PEIRCE (Richmond), speaking of underground adits, said that at Richmond they had executed 6000 feet of tunnelling; and to avoid passing under private property, they had to go in the most zig-zag fashion—following streets and lanes, and any piece of land under which they had permission to go—and yet owners had a suspicion that they were driving under their property. It seemed really unkind that they should prevent them driving, at a depth of 300 feet in the chalk below the surface, under a favourable piece of property, and so cause them frequently to have to take an acute angle. He could not understand this, especially when it was a corporation water undertaking.

Mr. C. H. PRIESTLEY (Cardiff), alluding to the author's remarks as to water for domestic supply being drawn off near the surface of the reservoir, quoted from a paper by Professor Frankland, to show that the number of bacteria decreased the lower they went from the surface of the water. It therefore followed that the water in a reservoir 60 feet deep was better at half, or 40 or 50 feet of its depth than near the surface. The author had also said that every system of gravitation should provide storage room to the full extent of the rainfall. It seemed to him (Mr. Priestley) it would be a rather expensive matter for a corporation to provide three or four reservoirs when one would be sufficient for the time being. He thought no corporation should be called upon to construct storage for more water than they were likely to require for a reasonable time—say, for ten years in advance. Mr. Watts also advocated that, in order to prevent pollution of any kind, drainage areas should belong to the works. This would perhaps be beneficial; but at Cardiff they would have had to spend for this purpose, at £50 an acre, about half a million of money at the start. In his case, compensation was given continuously.

Mr. W. JONES (Pontypridd) spoke of the difficulties he had experienced in supplying water to small villages. The Parish Councils got them to do the work; but afterwards they were not so enthusiastic in insisting that householders should take a supply. As to placing fish in reservoirs, a few years ago he found that, in the case of one reservoir under his control, which was supplied by a mountain stream, a number of small tadpoles had found their way into it; and these gave him considerable trouble. He got rid of these by introducing fish from Loch Leven. He also referred to the difficulties he had had with several acres of peat in the watershed supplying one of his reservoirs, and to the beneficial results which had attended the draining of that bed.

Mr. E. SANDEMAN (Plymouth) thought there was no reason why a corporation should not carry out work as well as a contractor—in fact, there was no doubt the former would do it better. The question of plant was not a serious one. The proportion of the cost of the plant to the cost of the work was really not considerable on works of fairly large size; and, if the plant was new at the commencement, a fair price would be obtained for it afterwards. He was now carrying out, by administration, works that would cost £150,000; and up to the present time, they had been done within the estimate. He thought the draining of peat beds would be exceedingly expensive—not in the actual draining; but in the effect it would have on the storage. In a case he could quote, where the dry weather flow was very large, to reduce that by one-half by draining the peat beds would necessitate the construction of a very large storage reservoir. On the question of the dry-weather flow, he said it

would be very interesting if they could have a compilation of the dry weather flows in different districts, as there must be considerable variation.

Mr. J. SHAW (Boston), alluding to the purchase of land, said that anyone who had had anything to do with the purchase of land in moorland districts (where it was worth next to nothing) must have come to the conclusion that arbitration was a failure; and in regard to compensation water, in many cases the rainfall was calculated at a much higher figure than it came out at when the works were constructed, and yet the amount of compensation to be given did not vary. He knew of one place where the compensation water was calculated at two-thirds of the rainfall. The springs fell fully 220 cubic feet per minute; and the corporation had either to pay the value of the water in money or deliver the whole of the water into the stream. At the Boston works perhaps they held the record in England for lowness. The drainage area was about 3 square miles; and in some years, they had as high a rainfall as 24 inches! The average was 19 inches; and in 1887, it was 12½ inches. The dry-weather "flow" from the three square miles had been nothing for months at a time. (Laughter.) Regarding the construction of works, he believed that, in the long run, the cheapest work was done by contractors.

Mr. PEIRCE asked to be allowed to add to his previous remarks that there were certain kinds of work that Corporations could undertake with profit—such as adit driving. They had had adits driven at Richmond at the rate of £4 per foot; and it was found that, having a great deal of this work to do, the cost would be excessive. He therefore suggested that the contractor's plant should be purchased; and the works carried out by corporation men. They had been doing this for about five years; and taking the whole cost of plant, &c., the work had been executed at 30s. per foot, and the last at £1 1s. 5d. The adits were 6 ft. high; 4 ft. 6 in. wide; and grip 1 ft. deep.

Mr. W. TERREY (Sheffield) said it was exceedingly difficult to dogmatize on a question such as contract work *versus* administration—to say whether it was cheaper for work to be done by contractors or otherwise. It depended largely on the character of the work on which they were engaged, and on the contractor himself. He had not met many philanthropic contractors. They, of course, worked to make a profit; but he did not see why conscientious officials who took an interest in their work should not push on their men, and put the profits in the pockets of the people they served. Therefore, in the hands of such officials, the work should turn out quite as cheaply as in those of a contractor. In regard to the purchase of land, he much preferred negotiating in a friendly way to driving the matter to arbitration; but it was really wonderful how the value of the land was enhanced the moment they began to treat.

Mr. H. ASHTON HILL (South Staffordshire Water Company), speaking of the flow of streams, said he had two catchment areas in his district; and in one of them, he had a stream which ran at the rate of ½ million gallons per day up to (say) 4 millions maximum. This was eight times as much, instead of 800. The greater part of the year it ran perhaps at ¾ million gallons; and it did not seem to matter whether it rained or not. Not many miles away, he had another series of streams (this was the larger area of the two, being perhaps some 20 square miles); and the minimum flow was ½ million gallons per day. But it went up to probably 50 million gallons, or 100 times the minimum flow. If within three or four miles, they obtained such varying conditions, what great variations there must be throughout the country! Therefore they should not take it as a rule that the maximum flow was 800 times the minimum. As to contract work *versus* administration, if they were to discuss the matter for twenty-four hours, they would not make the contractors bankrupt, and would still have to employ them. In some cases, he let work out to contractors; and in others, he did it himself. The bane of the contract system was the acceptance of the lowest tender by committees and councils. Of course, in cases where they were subject to such a system—the lowest tender, and a man of straw—it would be better to get the work into their own hands. As to the point from which the water should be drawn from a reservoir, he agreed that it should be some distance down. It was a common thing to have the sluice-valve 15 feet down, or thereabouts.

Mr. H. ROBERTS (Ipswich) thought the fairest arrangement with out-districts was for the authority requiring the water to lay the mains in their own area, and to receive the water by meter. As to storage accommodation, he did not think ten years in advance was long enough; but allowance ought rather to be made, and accommodation provided, for the length of time for which the money was borrowed. He did not think that the present generation should pay for posterity.

Mr. C. SAINTY (Windsor) agreed with the author as to corporations undertaking their own work, some of which could be done much cheaper by them than by contractors. On the question of the supply of outside districts, he said that, in his case if they had a requisition from the owners to lay mains, they had to guarantee the Corporation 10 per cent. on the outlay for three years, after which the consumers came on the ordinary rateable value, which meant a loss to the Corporation.

Mr. TERREY said at Sheffield they had met the question of the supply of outside districts in this way. They laid the pipes, and supplied the water through meters into tanks erected by the authorities; and they entered into an agreement with them that they would take a certain maximum quantity of water, which maximum represented considerably more than the 10 per cent. They said to them, "You shall pay us that maximum, or your minimum shall never be less than half the maximum." In this way, they threw the distribution of the water upon the shoulders of those who were responsible.

Mr. J. W. SCHOFIELD (Huddersfield) said in his case they asked for 10 per cent., and held the authority responsible for meeting the deficiency if the payments turned out less. As to supplying water in bulk, they always said "nay" to everybody outside, simply because it was more remunerative to sell their own water, and make their own collections.

Mr. W. WHITAKER, F.R.S., thought that Mr. Watts was fully justified in the remarks he had made as to the public tendency to get as much out of corporations or companies as possible; but it was, in his opinion, much better that it should be so than otherwise. The author also said that a similar feeling often influenced juries in the law courts; and in cases of arbitration, umpires inclined to the individual side as the weaker factor in the case. This, he could only say, would ever be the case; and British juries and arbitrators would always feel in that way, because it was certainly better that a rich corporation should be mulct in a few hundred pounds than a poor man be ruined for the benefit of the corporation.

Mr. R. H. SWINDLEHURST (Bolton) sent a communication dealing with various points in the paper; and it was read by the SECRETARY. The writer expressed the opinion that the best of all gathering-grounds was a good clean grouse moor, and the barren district of rock or land destitute of vegetation, and remote from the pollution of towns, at high elevations and declivities, such as surrounded the lakes of Cumberland and Westmoreland. Drainage areas like the latter had comparatively few springs upon them; but there were many streams which were at times roaring torrents, and at other times almost dry. His experience of flood water flowing into a compensation reservoir (with a holding capacity of 550 million gallons) was that it invariably took from a month to three months to get clear; and if it was a wet year, it hardly ever cleared itself. To remedy this, some £10,000 had been expended in erecting several miles of retaining-walls and other works to protect the banks of the streams from being washed down into the reservoir. As to compensation water, millowners were very tenacious of their rights, and would spend enormous sums in opposing water-works schemes. Bolton had had a lively experience of this. For the abstraction of 7 million gallons per day for domestic supply, they had to give compensation to the amount of 11,880,000 gallons; and out of this 1,080,000 gallons had to be filtered, and conveyed in pipes to bleaching works.

Mr. WATTS, in replying, said he had been engaged now for a great number of years in executing large works for corporations; and the whole of the work had been done by administration, and he thought successfully. In proceeding with work of this kind, it depended greatly upon how they marshalled their men. He selected a man as leader for each gang; and kept the gangs as small as was consistent with the class of work upon which they were employed. He had few fish in his reservoirs, for the simple reason that there was no food for them to live on. Tadpoles ought not to exist in reservoirs for domestic water supply, and would not if the reservoirs were shingled round. The point he wished to make in regard to large corporation schemes (such as Vyrnwy and Thirlmere) and the supply of the villages on the line of aqueduct was this—that, when the time came that the Corporations required the water themselves, they would cease to supply the little villages they had taken on. He quite agreed that it was better to sink trial-holes than bore-holes; but it was somewhat dangerous to make experimental borings on land that had not been purchased, for something might be discovered that would lead the landowner to put an increased value on it. As to the point at which water should be drawn from a reservoir, his experience was that water at the bottom, and especially in peaty districts, if it was not drawn off frequently, began to smell. If he had plenty, he used the bottom water for compensation. It must be that precipitation began at the surface; and volume by volume, the water got more turbid. He found great benefit in draining moorland peat, because he not only got the water pure, but he had more of it, seeing that there was less discoloured water to pass by in flood time. It was true more storage was required; but even then they ought to profit. As to the execution of new works, it must not be thought that, because a contractor was provided with plant he gave it to them. He not only sunk it in his work, but he would have interest upon it.

A hearty vote of thanks was accorded to Mr. Watts for his paper.

An Anti-Rust Process.—A process for the protection of iron structures against rust has been suggested by M. Deninger, of Dresden. It consists of treating the iron with a solution of ferro-cyanide, which forms a coating of cyanide of iron. The following is the method adopted: The solution is mixed with a flaxseed varnish to which has been added a little turpentine or benzol, so as to cause a very homogeneous emulsion which can be applied without difficulty. The evaporation of the alcohol leaves the varnish, which forms a coat protecting the cyanide of iron deposited on the iron. There is no necessity for previously preparing the iron in any way, beyond removing the rust.

THE WATER SUPPLY OF SMALL TOWNS AND RURAL DISTRICTS.

In the "JOURNAL" for Jan. 26, we published some extracts from a paper read by Mr. PERCY GRIFFITH, Assoc.M.Inst.C.E., on the above subject before the Society of Engineers in the past session. As already mentioned, the author cited, in illustration of his subject, several works which appeared to possess features of interest in connection with water-works engineering for small towns and rural districts; and of these we now give a few particulars.

The first works selected were those carried out at Halstead, Essex, by the late Mr. Jabez Church, with whom Mr. Griffith was associated; but as these were described by the author in a paper read by him before the British Association of Water-Works Engineers in July last, and noticed in our report of the proceedings, they need not be again referred to. We therefore pass to the next illustration—the second water-works constructed for Godalming. Mr. Griffith selected these for description because they presented difficulties of a somewhat unusual character. The original works (erected in 1880) consisted of a well, with pumping machinery and reservoirs. But, owing to the rapid increase in the population of the district, the works became in 1885 too small to meet the increased demand for water; and a new source of supply had to be found, and the necessary pumping machinery erected. It was decided, upon Mr. Church's advice, after a careful inspection of the physical and geological conditions of the surrounding district, to impound the water from a spring, issuing from the base of a group of hills about 300 feet high, which had been, since the memory of the oldest inhabitant, remarkable for the constancy of its yield both in wet and dry seasons. For this purpose, a piece of land was purchased, including the outlet of the spring and sufficient of the hillsideto allow of the necessary headings being driven. The original intention was to construct a reservoir, the inner wall of which should, with projecting arms of puddle 30 feet long at either end, form the dam, which should itself act as the storage necessary to equalize the varying demands of pumping, and at the same time allow for the settlement of any sand or grit which might be carried through with the water. The following details of the method of carrying out the work were supplied to the author by Mr. W. Wood, Assoc.M.Inst.C.E., who was Resident Engineer during its execution.

Directly the excavation was commenced, it was evident that great care would have to be exercised to avoid diverting, and in all probability losing, the spring, as the soil immediately under the surface was found to consist almost entirely of fine impalpable sand and earth saturated with water, which would not only have formed a ready means of escape for the spring, but was also very liable to fall into and choke the main natural outlet if disturbed in its immediate vicinity. The natural slope of the site gave a depth of 4 feet of excavation on the front side of the reservoir and 30 feet under the hill; and the difficulty of keeping back a mass of saturated ground of this height while the inner wall or dam was erected was very great. Ordinary strutting and timbering were found to be useless; potholes abounding in every direction, which caused frequent subsidence of the earth over and around the spring. Owing to this cause, it was necessary, at this stage of the work, to clear the natural channel through which the spring emerged from the hillside every night and morning, to prevent its becoming choked. Piling had at last to be resorted to; and piles 14-inch die square, and averaging 30 feet long, were driven behind the inner wall of the reservoir. Cross timbering 6 in. by 4 in. was fixed to these by iron cleats; and stout runners 7 in. by 3 in. were then driven down behind this—the joints being packed with straw at the back to prevent escape of the running sand. This proved effectual in keeping the hill in check during the driving of the headings and the construction of the reservoir.

As the excavation proceeded, spring stones were observed at several other points besides the outlet of the original spring; and these were marked with piles to enable them to be easily found. One was only 12 feet away from the first spring; but there were in all four new ones beyond the first revealed as the work advanced. The method adopted in order to collect the water from the springs absolutely free from contamination by surface water was as follows: A pile was driven into the ground opposite each spring, and 7-inch cast-iron pipes, the front length in each case having a cutting edge, were forced into the natural spring channe's, as far as was considered necessary, by means of screw jacks. Cement concrete was then laid round the pipes wherever they were exposed. Two peculiar characteristics of the springs are worth recording. First, each spring appeared to be entirely independent of the others—no difference in the flow of one being apparent as the others were tapped, though they were all situated but a few yards from each other; secondly, the flow of the water through the fine sand had formed natural pipes circular in section, about 12 or 14 inches in diameter and from 1 to 2 inches thick, due to the petrifaction of the sides of the channels. After tapping the springs, channels were made by timbering round the outer ends of the pipes and excavating the soil at these points. Then 24-inch pipes, 12 feet long, were laid in these channels to within 3 feet of the 7-inch pipes; and the open spaces were arched over with concrete to exclude the surface water, and to form chambers for the deposit of sand.

Owing to the presence of potholes and small springs, the excavation for the reservoir itself was a matter of some difficulty. To meet this, however, a drainage channel 6 feet wide was dug round the outer edge, and all potholes and springs were filled in with concrete. In the latter case, oak slabs were first laid across the openings to form a solid base for the concrete. As the bottom of the reservoir was filled in, the water was forced away into the drainage channel or elsewhere, though for some time the concrete practically floated on the running sand until the pressure became sufficient to force it on to a natural bed. After the concrete bottom had been laid over the whole area and all settlement had ceased, the walls were commenced, and the rest of the work completed without further difficulty. The reservoir as completed is 80 ft. by 40 ft., and 6 ft. 6 in. deep, affording storage, when full, for 130,000 gallons. The cost of this portion of the work was £2730. On completion, a test was made to prove the available supply of water; and it was found to be ample in quantity and of exceptional quality.

The pumping machinery was then proceeded with. This was of some special interest, as a gas-engine instead of a steam-engine and boiler was adopted as the motive power. The engine, made by Messrs. Crossley Bros., Limited, is of 16 nominal horse power (at that time the largest size made), and drives a set of double pumps 8½ inches in diameter and 22-inch stroke, throwing a net volume of 7000 gallons per hour to the service reservoirs, which are respectively 187 feet and 350 feet above the pumping-station. A new rising main 8 inches in diameter between these points (a distance of about two miles) was included in this contract; and a corrugated iron shed was temporarily erected over the engine and pumps.

As regards the subsequent working of this plant, ordinary gas, supplied by the local Gas Company, at 4s. 3d. per 1000 cubic feet, was at first used. But this was found to cost nearly as much as the coal required for a steam-engine; and it was therefore decided to put down a small Dowson gas plant. This proved a very considerable economy; the cost of pumping with the new plant being one-fourth of that involved by the steam-engine and boiler, though it must be added that the latter (with the well pumps) were five or six years old at the date of the test, and the pump-valves were much scored by sand. The following figures show the cost per 1000 gallons of water pumped by the several methods tried: Steam-engine and well pumps, 4·916d.; gas-engine with town gas, 3·617d.; do. with Dowson gas, 1·268d.; do. do. after repair of pumps, 1·069d.; do. do. (later test) 1·483d. The head of water was 160 feet, except for four hours a day when it was 200 feet. There is no doubt that gas-engines are not only very suitable for small water-works, but are cheaper, both in first cost and working, than steam-engines; and this will, the author believes, be borne out by most engineers who have adopted them as motive power under similar circumstances. For larger works, of course, they do not compare quite so favourably with steam-engines, owing to the greater economy of condensing engines, which can usually be adopted in such cases. There now, however, a more modern type of motive power which is worth some attention, owing to its application being in a far less advanced stage—viz., the oil-engine. As few records have yet been published regarding these engines, the author has obtained the following particulars of some small water-works where they have been adopted to drive pumping machinery.

The Blandford (Dorset) Water-Works were erected in 1894 from the designs and under the supervision of Mr. F. Beesley, M.Inst.C.E., who has kindly permitted the author to publish the following particulars: The population supplied from the works numbers about 4000; and a domestic supply of 20 gallons per head per day has been provided, in addition to 60,000 gallons per day for trade purposes. The works consist of a well and boring sunk into the chalk; the former being 36 feet deep and 7 ft. 6 in. diameter, and the latter 100 feet deep and 9 inches in diameter, from which an ample supply of water has been obtained. The pumps, which are in duplicate, are driven by 19 brake-horse-power oil-engines of the Hornsby-Ackroyd type, and deliver the water through about a mile of 7-inch main to the reservoir, which has a capacity of 140,000 gallons (one day's supply), and gives a total lift of 250 feet. The cost of the works was £7500, or £1 17s. 6d. per head of the population.

The Fenny Stratford Water-Works were designed by Mr. John Eunson, M.Inst.C.E., of Northampton, to whom the author is indebted for the following particulars respecting them: The population to be supplied numbers about 5000; but as parts of the district are being rapidly developed, provision has been made for 10,000 persons. The well and pumping-station are situated about 3½ miles from Fenny Stratford, and the same distance from Bletchley station. The well is 7 feet in diameter, and is sunk into the lower greensand; touching the Oxford clay at about 30 feet. A good supply of water was obtained from the lower beds of the greensand, which maintained its flow on a trial pumping of 200 hours at the rate of 6500 gallons per hour. The pumping machinery consists of 7-horse power Hornsby-Ackroyd oil-engines in duplicate, geared to well pumps, which are of the bucket and plunger type, 10 inches in diameter and 18-inch stroke, also in duplicate. The pumps deliver the water to a service reservoir 876 yards distant from the pumping-station, and 163 feet above the well. The capacity of each pump is 5500 gallons per hour. The reservoir contains 100,000 gallons

of water when full; and from it some 16,000 yards of distributing mains, from 6 to 2 inches in diameter, are laid to the various centres of supply. The cost of the works was £5790, or at the rate of £1 3s. 4d. per head of the present population; but this does not include the cost of the land, which Mr. Eunson states was considerable, owing to the heavy demands made by the owners, nor that of the well, the fees to the engineer, &c. With regard to the working expenses, a test showed the cost per day of 8½ hours, with oil at 5d. per gallon, to be 8s. 6d., or at the rate of 1·33d. per 1000 gallons pumped 100 feet high—a figure which does not compare very favourably with the cost of working the Godalming gas-engine plant, but which is no doubt lower than the cost of steam power would have been.

The Swanland Water-Works were for a purely village supply; the population being only 600, though rapidly increasing owing to Swanland being within six miles of Hull. They comprise a 3-horse power (nominal) Priestman oil-engine, driving a set of three-throw pumps, each 4 inches in diameter with 10-inch stroke, fixed in the well, which is 240 feet deep. The pumps throw 870 gallons per hour. The reservoir is a cast-iron square tank 13 ft. 6 in. square in plan, and 10 feet deep, placed on a brick tower at an elevation of 60 feet above the engine-room floor. There are only a few services connected direct to the houses; the general supply being taken from stand-pipes placed in the roads. The cost of the works was £968, or about £1 12s. per head of the present population—a very low figure for such a small undertaking. With regard to the working, careful tests have given the following results: Gallons of water lifted 300 feet high, per pint of oil used, 317; cost of pumping, per 1000 gallons, 1·49d.; labour (attendant), 8s. per week in addition. The works were designed by Colonel Wellsted, the Surveyor to the Sanitary Authority.

The Sonning Water-Works were erected in 1893 under the supervision of Mr. Marshall, of Knebworth, for the Wokingham Rural Sanitary Authority; the population being about 600 normally, but much greater in the summer months. A supply of 100 gallons of water per minute was obtained from a boring driven into the chalk to a depth of 75 feet; and it stands at about 10 or 11 feet below the surface. The engine is a 2 brake-horse-power Priestman oil-engine, and drives a set of three-throw ram pumps, each 4 inches in diameter with 9-inch stroke, by means of belting. The capacity of this plant is equal to 14,000 gallons per six hours, under a total head of 100 feet from boring to reservoir. This is 28 ft. 6 in. square and 8 feet deep, containing 35,000 gallons when full. There are about 4½ miles of mains, 4 and 3 inches in diameter, in the district. The following result was obtained on a working test: Cost of materials (including oil at 5d. per gallon) per 1000 gallons of water lifted 100 feet, 1·267d. The cost of the works was £1840, or about £3 per head of the minimum population—a figure which would have been far lower had the population been larger, as the works are equal to the maximum population during the summer months. One interesting feature of these works should be mentioned. The pumping-station being situated in a ploughed field, and in an extremely rural district, the convenience and economy of a light portable fuel like oil are especially manifest.

Appended to the paper, which was illustrated by diagrams, were some interesting statistics relating to twenty-nine small water-works, including particulars which, as far as the author was aware, had not previously been published.

Institution of Mechanical Engineers.—At the recent annual general meeting of the Institution, the Council reported that the number of names in all classes on the roll at the end of last year was 2360, as compared with 2271 at the close of the previous year; showing a net gain of 89. The receipts during the year were £7388; while the expenditure was £5215. The President (Mr. E. Windsor Richards), in moving the adoption of the report, said this was the jubilee year of the Institution, which was formed fifty years ago in Birmingham; and it was proposed to hold the summer meeting in the city of its birth. The Institution was financially in a prosperous condition. Its capital was estimated at about £46,000; whereas in 1895 it was £42,000, and in 1894 only £39,000. The Council have acquired a site at Storey's Gate, Westminster, and upon it a house is being erected for the purposes of the Institution.

Gas-Engines and Modern Flour-Mills.—In a recent number of "Engineering," a correspondent gave some particulars as to the working arrangements of the new flour mill lately started in Paris by the Société des Moulins Truffant. It is driven by two large single-cylinder horizontal "Simplex" gas-engines, each indicating some 250-horse power, with single fly-wheel. It works night and day, and receives cheap gas, made with special plant from French coal by the Lencauchez system. The gas-engines have been constructed according to the system of MM. Delamare-Debouteville and Maladin, with electric ignition, and working at 100 revolutions. A third gas-engine, of 30-horse power, drives a dynamo for lighting the mill. The consumption of small Anzin French coal in the gas-generator is expected to be 1¼ lbs. per brake-horse power per hour; but tests have not yet been made. The main shaft of the mill runs at 200 revolutions per minute, and is driven by a strap, 2 feet wide, from each of the gas-engine fly-wheels. The mill is to produce 100 tons of flour per 24 hours. The gas-engines are easily set going by a self-starter, and were working well during the writer's visit.

REGISTER OF PATENTS.

Prepayment Gas-Meters.—Sutherland, J. G., of Kennington, S.E. No. 19,425; Oct. 16, 1895.

This prepayment mechanism is connected with the flag-wire or other moving part of the meter, the motions of which are utilized in operating the mechanism in the delivery of gas to the consumer.

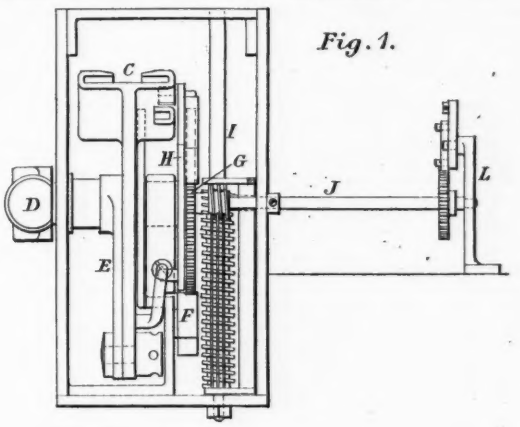


Fig. 1.

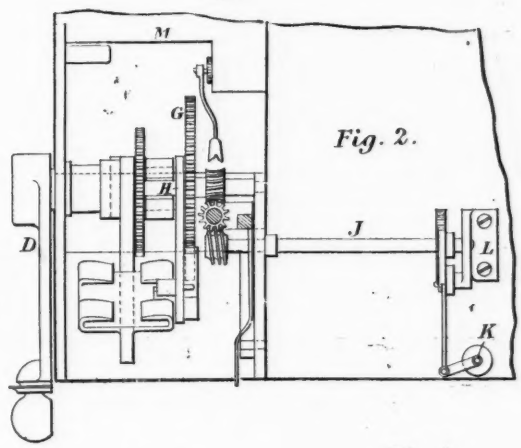


Fig. 2.

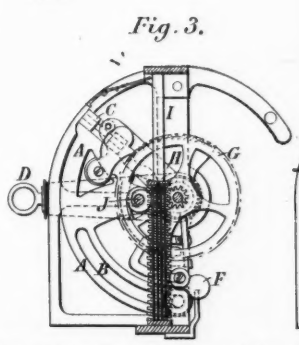


Fig. 3.

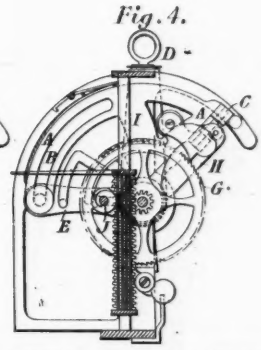


Fig. 4.

Fig. 1 is a front elevation of the apparatus. Fig. 2 is a top view. Figs. 3 and 4 are sectional elevations—the latter showing the apparatus in the "paid" position.

A is a segmental frame, having a segmental slot B through one portion, and a cradle C to receive the coin at one end. A sleeve is carried through the frame to support the boss of the handle D; both the segmental frame and the handle being fast on the sleeve. E is a radial arm (loose on the sleeve), used to regulate the amount of gas to be delivered to the consumer for the coin inserted in the case—the amount being indicated by the number of strokes upon a bell or wire (not shown), the clapper of the bell being attached to a pawl F; and the motion of the pawl being produced by its contact with the ratchet-teeth upon the wheel G. The position of the radial arm E in the slot B is regulated by set screws, fitted with a capstan head for the purpose. The radial arm is also fitted with a crooked rod to engage with a stop on the segmental extension of the arm H, whereby the latter is drawn back ready for the next payment. Fixed to the frame is a standard, having a segmental serrated edge, upon which the edge of the coin rests; the coin being carried by the cradle upon and over the diagonal faces of the serrated teeth in one direction, and being incapable of moving in a contrary direction against the radial faces of the teeth—thus preventing the operation known as "pumping." The arm H is pivoted loosely upon a shaft, and carries a pawl attached to the segmental end of it. There is also a pawl pivoted to the frame. The pawls engage the ratchet-teeth of the wheel G—one acting as a driver, and the other as a check to prevent the wheel moving in an opposite direction to that effected by the first pawl. The cradle is formed so as to carry the coin against a stop, and thereby cause the ratchet-wheel G and its pinion to rotate a certain distance. In the absence of a coin, the cradle passes the stop without operating the mechanism.

A stationary vertical spindle I is fixed to the frame; and upon the

spindle a sleeve is fitted, free to rotate and also to slide up and down upon it. A worm or screw thread is formed upon the sleeve; and a screw-thread is also cut longitudinally on it, so as to form teeth and act as a pinion. Another worm is fitted to the shaft J; being driven in one direction only by the mechanism shown. This consists of the shaft J, suitably mounted in bearings carrying a worm at one end and a ratchet-wheel at the other. The latter is preferably operated by a lever attached to the flag-wire K, which imparts reciprocating motion to a pawl or a pawl-lever mounted on the bracket L.

The valve-box M and valve N are fitted outside the meter-case, but enclosed in the prepayment mechanism case, as shown in fig. 2. The valve is preferably of the flap-valve type—the lid or disc being formed slightly concave, to receive a pad of wool saturated with a lubricant; the pad being held in place by skin or leather stretched over it, and fastened to the disc. The valve is preferably operated from the sliding worm-sleeve carriage by two fingers, which act on a lever or tappet secured to one end of a spindle passing through a stuffing-box fixed in the valve-box M, and carrying another lever connected to a valve by a rod. It will thus be seen that, when the worm-sleeve is down, the valve is shut; but on an upward motion being imparted to the sleeve, the fingers move the lever, whereby the valve is opened and retained open (by friction) until the return of the worm-sleeve, when the finger again moves the lever down, thereby shutting the valve. This arrangement of outside valve-box enables occasional examination of the valve to be made, without breaking the official seal affixed at the testing-station.

In using the apparatus, the handle D is moved to the position shown by the dotted lines in fig. 3. The coin being inserted, the handle is then moved to the position indicated in fig. 4. This movement causes the coin to move the ratchet-wheel a certain distance before falling out of the cradle. The worm pinion attached to it raises the sleeve and operates the indicator; and the apparatus is then ready for delivering gas.

Dry Gas-Meters.—Hughes, T., of Dalston. No. 5029; March 5, 1896.

The patentee proposes to make complete in itself the collapsible gas-bag forming the side of the measuring chamber of the meter, and fix it in its place (without the use of the soldering iron) by a screw union. The "bag" consists of two discs of tin plate, flanged inwards and grooved around the face of the flange. The cylinder of leather serving as the flexible part of the bag, is received at its ends into the flanges of the discs; and the leather is clamped on to the flanges by stout wire rings. The wire is half round in section; the ends of the ring being bent out radially, and then brought together and screwed. They receive a nut which draws the ring tight, causing it to clip the leather to the flange. The disc at the inner end of the bag is provided with a radial neck or inlet passage, to which an elbow bend is fixed. The bend carries upon it the nut of the screw union; and the nozzle part is one wall of the compartment which contains the bag.

Testing-Machines for Gas-Meters.—Chollar, B. E., of St. Louis, Missouri, U.S.A. No. 17,751; Aug. 11, 1896.

The object of this invention is to provide a device for the purpose of testing the accuracy of gas and like meters, and also keeping a record of the errors discovered.

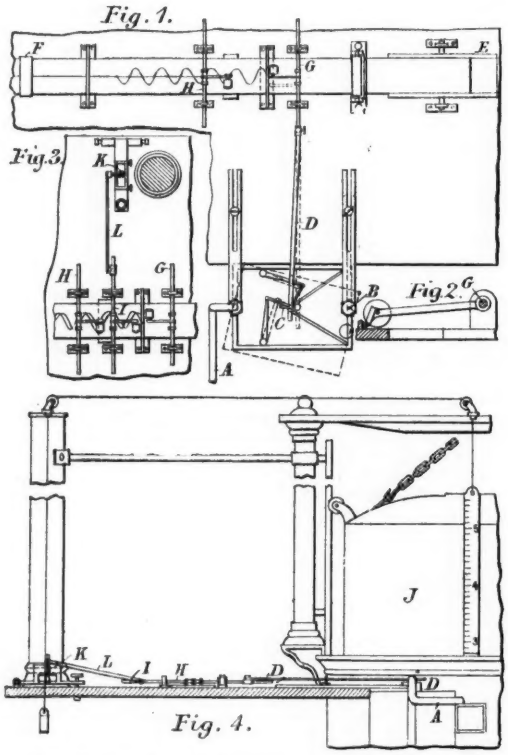


Fig. 4.

Fig. 1 is a plan of the recording apparatus, and the position of the meter while being tested. Fig. 2 is an enlarged side elevation of one of the markers. Fig. 3 is a top view of a second recording device, for the purpose of verifying the first. Fig. 4 is a side elevation of the device.

The meter to be tested is secured to a table by thumb-screws engaging slotted bars. The gas enters the meter through the feed-pipe A, and is exhausted through the pipe B. As the gas passes through the meter-valves, the crank C is caused to revolve. The crank is pivoted to a rod D; and its rotary motion is thus converted into a backward and forward motion. On the reel E paper is, by any suitable mechanism, drawn at a uniform speed under a roller and through guides, and out under a roller F. Supported on standards on each side of this paper strip is a moveable rod G, to which is secured an arm bearing a pencil. Similar standards, placed as shown, support a rod H. This likewise carries fixed thereon an arm and a pencil. It is threaded at one end; and the arm and pencil are held in any desired fixed position by an adjusting nut. As the paper travels from right to left, the pencil on the rod H makes a straight mark down its middle. To the end of the rod G is attached a rod so arranged as to move back and forth, so that the pencil on it will leave a waved line on the moving paper. A third set of standards support a rod I situated between the other two rods. It also carries an arm and pencil.

J is a gasholder, the capacity of which is carefully shown on a graduated scale. Gas is fed from the reservoir through the pipe A to the meter to be tested. Attached to the reservoir is a wire, which passes over pulleys supported on a suitable framework. The other end of the wire is attached to a weight; and the wire is wound round a spindle K placed in an adjustable frame, attached to the table by a hinge-bearing at one end and a screw-bolt at the other. As the gas is exhausted and the holder sinks, the drawing of the wire by the weight causes the spindle to revolve. It carries a crank, to which, by means of a slot and set-screw, is connected the rod L. This rod is attached to the rod I by a screw. It will thus be seen that the pencil on the rod I will describe a second wave down the moving paper—being propelled by the movement of the rod L.

The meter to be tested is first secured to the table; and the rod D is then attached to the crank, and the paper strip is started in motion. Gas or like fluid is passed through the meter; and the motion imparted to the pencil on the rod G causes a wave-line (as shown) to be drawn. The capacity of the chamber varies in different meters; consequently the same number of waves per cubic foot will not be shown in the different meters. In the drawing are depicted six waves—supposed to be the result of the one cubic foot of gas passing through the meter. After the apparatus is started, the pencil on the rod H is adjusted so as to describe a straight line directly between the crest and trough of the wave. The distance from this line to the crest, ought to equal the distance to the trough—any variation will show a defect in the adjustment. A complete revolution of the crank C will describe a complete wave, which will indicate that all the valves are used once. The portion of the wave above the straight line shows one-half the meter; and that below the line, the other half. If one varies from the other, it will indicate that one meter chamber is unequal to the other.

The pencil on the rod I (describing a second wave, and operated as explained) provides means of comparison of the first wave made by a pencil operated by the meter. The number of these waves per cubic foot is regulated by the diameter of the spindle K to correspond with the number described by the marker on G. The height of the wave is regulated by the adjustment of the crank-pin and slot. As the same body of gas now controls the movement of both pencils, the two lines should be isometric. The line described by the other pencil, being controlled by exhaustion of gas in the holder, and without the intervention of meter 2, will be symmetrical. Any variation from this in the line described by the first pencil will indicate that there is a fault somewhere in the meter.

Governors for Gas-Engines.—Caldwell, R., of Auckland, New Zealand. No. 24,858; Nov. 6, 1896.

This governor, more particularly applicable to gas-engines and the like, consists in one form of a disc provided with an arm, which (at slow speeds or when the engine is at rest) is normally held in position by a spring; but at speeds greater than required, the resistance of the spring is overcome by centrifugal force, and the arm projects beyond the periphery of the disc. When in the latter position, the arm touches the spindle of the valve at each revolution—keeping it closed for a longer or shorter length of time according to the distance the arm is advanced by the speed of the engine. In slow speeds or when the engine is at rest, the valve is kept open by a spring; and the regulation of the admission of explosive mixture to the cylinder is effected by closing or partially closing it as mentioned.

Manufacture of Fluid for Impregnating Fabrics, Threads, Fibres, or the like, for Illuminating or Lighting Purposes.—Puchmüller, B., of Schöneberg, near Berlin. No. 26,167; Nov. 19, 1896.

The process for the manufacture of the above-mentioned fluid is as follows: Oxide of magnesia and oxide of barium are mixed with, or dissolved in, suitable acids—bismuth acid, antimonic acid, meta-antimonic acid, citric acid, aconitic acid, itaconic acid, citraconic acid, oxyallyltricarbonic acid—or with a combination of several suitable acids, and are evaporated by heat until a vitreous or salt-like residue is formed. This solidified residue is pulverized, and then dissolved in another suitable acid—nitric, tartaric dioxylsuccinic pyrotartaric, malic, succinic, or formic acid—or any suitable combination of acids. Finally, the solution may be mixed with distilled water, whereupon the fluid is ready for impregnating textile fabrics. The patentee claims that "by means of the interchangeability of the acids, and with the combination of several different acids, there may be obtained lights of different colour suitable to varying requirements."

Instead of oxide of magnesia and oxide of barium, oxides of strontium and uranium may be employed, which, on being treated with suitable acids and distilled water and dissolved, yield also a fluid capable of being used. The oxide of magnesia and oxide of barium dissolved by means of acid, and evaporated by heat, may also, after they have formed the vitreous or salt-like residue mentioned, have uranium oxide added to them, and be both reduced to powder and treated together with one of the last-mentioned acids, or they may be dissolved therein. Instead of the oxides of magnesia and barium, oxides of magnesia and strontium may be employed in the manner described.

APPLICATIONS FOR LETTERS PATENT.

3370.—Crossley, F. W., "Internal combustion motors." Feb. 9.
3381.—Hunter, J. W., "Gas or oil engines." Feb. 9.

3383.—Woodward, W. E., "Chimneys for use with incandescent or other gas-lamps." Feb. 9.
3479.—Schreiber, C., "Water-meters." Feb. 9.
3504.—Wilson, J., "Burners for incandescent gas lighting." Feb. 10.
3539.—Rose, A., "Burners for incandescent gas-lights." Feb. 10.
3607.—Franke, A., "Gas-burners." Feb. 10.
3629.—M'Donald, D., and Keiller, J. T., "Gas or lamp shade and smoke consumer." Feb. 11.
3639.—Thornhill, J. E. S., "Gas motor engines." Feb. 11.
3667.—Kent, H. A., "Inverted regenerative incandescent gas burners or lights." Feb. 11.
3668.—Carter, E. T., "Internal combustion engines." Feb. 11.
3690.—Wilde, P. R., "Gas and other stoves." Feb. 11.
3748.—Gemmell, J., "Making branch connections into gas or other pipe mains." Feb. 12.
3797.—Shaw, J. E., "Outside gas and other lamps or lanterns." Feb. 12.
3811.—Puchmüller, B., "An improved fluid and process of manufacturing same for impregnating bodies or suitable fabrics, threads, fibres, or the like for incandescent lighting purposes." Feb. 12.
3824.—Ploeg, J. P. van der, "Improvement of the heating system for incandescent burners." Feb. 12.
3890.—Auriol, P., "Gas-engines." Feb. 13.
3896.—Sharp, W. F., "Incandescent gas-lamps particularly applicable for streets and public places." Feb. 13.
3898.—Richard, F., "Manufacture of calcium and other carbides." Feb. 13.
3975.—Browne, E. L., "Acetylene gas generator." Feb. 13.
3981.—Cristiani, A. V., and Schölzig, O., "Generating, purifying, cooling, storing, and directly supplying acetylene gas." Feb. 13.
3983.—Webber, W., "Prepayment meters for gas or other fluids." Feb. 13.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Use of Inclined Retorts.

Sir,—In your comments upon the balance-sheet of the Brentford Gas Company, in the last issue of the "Journal," you state that you "believe that Brentford is the only gas-works in the United Kingdom wherein the inclined retort is exclusively used." At these works the whole of the gas made during the past three seasons has been solely by the inclined system, as there is not a single horizontal retort on the place.

W. Winstanley.

Newcastle, Staffs., Feb. 20, 1897.

The Use of Sulphate of Ammonia with Lime in Agriculture.

Sir,—I am naturally interested in the remarks on the use of sulphate of ammonia for agricultural purposes in the "Journal" this week. I have used it for several years, both in grass and ploughed land, with some amount of satisfaction; but, being in the habit of dressing the land with lime from the gas-works, I should be thankful if some of your readers would inform me how soon sulphate can be brought into contact with the lime without injury. I am at present mending my pastures with sulphate, and am only waiting for drier weather to do the same with the plough. I find it does not wash away so quickly as nitrate of soda with heavy rains. Mr. Carulla says: "This fact might clearly be used with power by all those who are interested in sulphate, to convince the farmer of the magnitude of his loss;" *but* "were the loss only his own, we might keep silence." I must thank him, on behalf of my brother farmers, for his sympathy.

G. Hart.

Canes, near Harlow, Feb. 19, 1897.

The Relation between Water Supply and Enteric Fever.

Sir,—During the last two years, it has been part of my official duty to investigate the variation and increase throughout Europe for the past half century, at certain periods of life, of the rate of mortality among adult males. Incidentally, I was led to examine into the relation between water supplies and enteric fever. As Parliament will have before them, in the coming session, many projects for water supply to large communities, I venture to ask that you will grant me space in your columns so that I may briefly place before your readers the rate of mortality in 1896 from fever, obtained from various official Government statistics. For comparison, and to avoid decimals, I have computed the mortality from fever, per million living, for a few typical towns, whose water supplies are drawn from widely different sources.

Rivers and Chalk.

London	137	Paris	110

Chalk.

Lemberg	288	Portsmouth	153
Rouen (and wells)	282*	Brighton	118
Hull	280	Rheims	131
Norwich	193	Lille	70
Epsom	190†		

Upland and Moorland.

Belfast	560	Birmingham (and wells in red sandstone)	214
Dublin	453	Leeds	213
Liverpool	322	Leicester	202
Sheffield	298	Brussels (and wells)	190
Manchester	229		
Glasgow	223		

Sand and Sand Lakes.

Copenhagen	74	Amsterdam	28
Berlin	65	Ghent	91
The Hague	38		

Limestone Water.

Linz	277	Liége	117
Prague (and River Moldene)	214	Gratz	101
		Pilsen	91

Snow Water Lakes. | *Mountain Water.*

Zurich	104	Nuremburg	42
Lausanne	82	Vienna	40
Geneva	51	Munich	32

Filtered River Waters.

Magdebourg	84	Dresden	42
Hamburg	58	Frankfurt	42
Cologne	49	Altona	41

Other Sources.

Malines (shallow surface wells)	993
Antwerp (river water, treated by iron filtration, and shallow wells)	154
Charlottenburg (ground water freed from its ferruginous matter by exposure to air)	87
Bristol (red sandstone)	79
Dorking (greensand)	70†

* Three-quarters of a year. † Mean of last ten years.

Unfortunately, I have been limited in my selection of English towns, as accurate information is at present unattainable, owing to the fact that the Registrar-General's mortality returns for the whole of England and Wales for 1896 will not be published until 1898.

It will be observed that towns drawing their water supply from sands, melted snow, and rivers have a lower rate of mortality from fever than those drawing their supply from either chalk, peat, or moorland gathering-ground.

Dr. Seaton, the County Medical Officer for Surrey, has shown in his report on water supplies that the mean death-rate from enteric fever for the last decade for Epsom and Sutton, which obtain their water exclusively from the chalk, was at the rate of 190 per million living; and that this rate was an increase over the mean death-rate of the previous decade. The mortality from fever at Reigate (another chalk supply) was 160. On the other hand, Dorking, which formerly derived its water from the chalk, but now obtains it from the greensand, had a mean death-rate of 70 per million, and shows a material diminution in the death-rate from this cause. In Chertsey, which derives its supply principally from the Thames, the mean death-rate from typhoid was 90 per million during the same period.

The chalk in the neighbourhood of our large towns is being progressively contaminated by the establishment on its surface of sewage farms, cemeteries, and even by the drainage from isolation hospitals. The rainfall percolating through a soil thus polluted, must pass in a contaminated condition through the joint planes and fissures down to the subterranean streams—the reservoirs of this water-bearing stratum. Surely the time has arrived for legislation for protection against further injury to this important source of supply.

A glance at the foregoing table suggests the probable existence of a law which further investigations will either confirm or refute.

In conclusion, I trust that I have made out a *primâ facie* case for an exhaustive Government inquiry as to the cause of the susceptibility to, and immunity from, fever among populations deriving their water supply from various sources. Moreover, it is at least open to discussion whether municipal bodies who are empowered to levy rates for sanitary administration, are suitable authorities to act as amateur managers of trading monopolies.

A. H. Smee, F.S.S.,
Deputy-Chairman and Chief Medical Adviser, Gresham Life Office.

St. Mildred's House, Poultry, E.C., Feb. 17, 1897.

Water-Works for North Walsham.—An application has been made by the North Walsham District Council to the Local Government Board for sanction to borrow £4000 to provide works for the water supply of the town. At an inquiry into the matter by Col. W. M. Ducat, it was declared by the Medical Officer (Mr. A. C. Morton) that the water from the wells in the town was impure, and that it was important water-works should be constructed. The Engineer (Mr. Melliss) stated that he proposed to pump water from the chalk, and build a reservoir to contain three days' supply.

Stratton and Bude Water Supply.—The inhabitants of Stratton and Bude are still discussing the water question, with little prospect of arriving at an agreement upon it. Nearly six months ago, the District Council sought the advice of Mr. Baldwin Latham, with a view to obtain a definite opinion as to the merits of the several schemes which were under consideration. Mr. Latham recommended that an agreement should be made with the Bude Canal Company for the purchase of their undertaking; the principal alternative scheme of a gravitation supply from Wrasford Moor being, in his opinion, too costly. The District Council proceeded to reopen negotiations with the Canal Company; but, after innumerable meetings, a resolution was recently carried to proceed with the Wrasford Moor scheme, but without constructing a storage reservoir. This decision, however, has by no means settled the question. At the next meeting of the Council, a number of amendments were submitted with a view to the modification of the scheme; and notice was finally given of a motion to rescind the resolution, and adopt the Bude Canal proposal. On the 8th inst. a meeting of ratepayers was held, at the instance of the Parish Council, at which a resolution was passed expressing the strong opinion that the Canal Company's reservoir would afford the best water supply for the district, and urging the Council to negotiate for its purchase, carry out the scheme, and proceed no further with the Wrasford Moor project, which Mr. Latham had condemned. A letter from a gentleman connected with the Canal Company was read, suggesting that an offer of £3000 should be made to the Company for the entire rights of the canal. Dr. King, the Chairman of the Council, said that body could do no business with the Canal Company; but he was willing to join with others in the purchase of the canal and the sale to the Council at the purchase price. It was the best scheme, if they could get it. It was understood decidedly that Dr. King should at once proceed to close with the offer to sell the canal rights for £3000.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills read a second time: Harrogate Water Bill, Tynemouth Gas Bill.

Bills committed: Cowes Gas Bill, Loughborough Corporation Bill, Taunton Gas Bill, Torquay Corporation Water Bill.

Bills dropped: Gravesend and Northfleet Water Board Bill, Gravesend Corporation Water Bill.

Petitions have been presented against the following Bills: Belfast Water Bill, Caerphilly Urban District Council Bill, Carnarvon Corporation Bill, Clydebank and District Water Bill, Eastbourne Corporation Water Bill, Fylde Water (Transfer) Bill, Gravesend and Milton Water Bill, Harrogate Corporation (Water Transfer) Bill, Hunstanton Water and Gas Bill, Lowestoft Corporation Bill, Lowestoft Water and Gas Bill, Malvern Link Urban District Gas Bill, Malvern Urban District Gas Bill, Newhaven and Seaford Water Bill, Newport Corporation Bill, Rhymney and Aber Valleys Gas and Water Bill, Southampton Corporation Water Bill, St. Anne's-on-the-Sea Gas Bill, Stirling Burgh (Gas) Bill, Tynemouth Corporation Water Bill, Tynemouth Gas Bill.

HOUSE OF COMMONS.

Last Thursday, Mr. Kearley (Devonport) asked the President of the Board of Trade whether he was aware that large quantities of carbide of calcium were being imported into this country; and whether, having regard to its dangerous nature when exposed to air, any steps were being taken to regulate its storage. If not, whether clause 14 of the Petroleum Act could be made to extend to its inclusion. Sir M. W. Ridley, in reply, said the dangers attending the storage and conveyance of carbide of calcium had been occupying the attention of the Inspectors of Explosives for some months; and steps were being taken to apply to this substance, by an Order in Council, the provisions of the Petroleum Acts. A memorandum would eventually be issued to local authorities, suggesting the precautions to be adopted for preventing risk.

The following progress was made with Bills last week:—

Bills read a second time and committed: Arundel Gas Bill, Ashford Gas Bill, Crays Gas Bill, Crowborough District Water Bill, Leeds Corporation Bill, New River Company Bill, Salford Corporation Bill.

The second reading of the London County Council's Water Purchase Bills, set down for last Thursday, has been postponed till the 11th prox. It is understood that Mr. Buxton has undertaken to essay the task of piloting them through the House.

Petitions have been presented against the following Bills: Ashford Urban District (Gas) Bill, Chichester Corporation Water Bill, Colne Corporation Bill, Crowborough District Water Bill, Devonport Water Bill, Dublin Corporation Bill, Dundee Corporation Bill, East London Water Bill, East Warwickshire Water Bill, Huddersfield Corporation Bill, Kent Water Board Bill, Kingston-upon-Hull Corporation Bill, Leeds Corporation Bill, Leicester Corporation Bill, London Water (Purchase) Bills, Manchester Corporation Bill, Newark Corporation Water Bill, New River Company Bill, Nottingham Corporation Water Bill, Pwllheli Corporation Bill, St. Neot's Water Bill, Salford Corporation Bill, Swadlincote District Gas Bill, Tuxford and District Gas Bill, Weymouth Gas Bill, Weymouth Water Bill.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, Feb. 17.

(*Before Mr. Justice* ROMER.)

The Incandescent Gas-Light Company, Limited, v. Boehm.

This was a motion to commit the defendant, Julius Boehm, for breach of the injunction granted against him on the 4th of December last.

Mr. TERRELL, Q.C., and Mr. WALTER appeared for the plaintiffs; Mr. BUCKMASTER represented the defendant.

When the case was called on,

Mr. BUCKMASTER said the defendant had been under the impression that he had not committed any breach of injunction by transferring his business to other persons, and by supplying them with materials for making mantles. But he (Counsel) had, after some trouble, convinced him that he could not maintain this position; and he did not therefore desire to occupy more time than was necessary.

Mr. TERRELL said this was a conspiracy on the part of several persons to carry on business on a gigantic scale, in defiance of the order of the Court; and he must press for a committal. He therefore proceeded to open the motion, and read affidavits by Daniel William Barnett, Elizabeth Webb, and W. A. Brampton—persons who had been in the service of the defendant—as well as by Mr. Backhouse, a tradesman of Bedford, deposing to the continued manufacture and sale of infringing mantles by the defendant; the production of the articles being carried on at his residence in Wiesbaden Road, Stoke Newington, and the goods being sent away from there, and also from Aldgate Avenue, where business was carried on under the name of the British Incandescent Mantle Manufacturing Company and the Universal Company. One witness spoke to ten and twelve gross of mantles a day being manufactured.

Barnett, on being cross-examined by Mr. BUCKMASTER, said he had been in the employment of defendant up to Jan. 26. He had been receiving money from the plaintiff Company for services as an "inquiry agent" since August last.

In re-examination by Mr. TERRELL, witness produced a number of documents in the defendant's handwriting, referring to the execution of orders for mantles in various stages of manufacture.

Mr. BUCKMASTER thereupon said he had been quite unaware of the existence of these documents; and on their production, he must retire from the case.

Defendant then appealed to his Lordship for an adjournment, in order that he might provide himself with an interpreter, and produce evidence to show that the plaintiffs' affidavits were all false.

After some discussion,

Justice ROMER said he would adjourn the case till Saturday morning; but he should not have done so except for the fact of the defendant being a foreigner.

Saturday, Feb. 20.

The hearing of the case was resumed this morning.

Mr. TERRELL said he desired to cross-examine Mr. Boehm; and he was thereupon directed to go into the witness-box.

Defendant admitted that since Dec. 4, when the injunction was granted, he had sold "stockings" (mantle fabrics), both raw and impregnated with fluid ready for burning off, but not ready for use. He could not say how many, nor could he say that he had told anyone that he had made large profits by this business. He did not make 500 per cent., as the Company did, but only 10 or 15 per cent. He obtained the fabrics from Germany. Before Dec. 5, he was connected with the British Manufacturing Company as Manager. He would not say who were the proprietors of that Company. He was not an informer; it was plaintiffs' business to find that out. Being cautioned by his Lordship, he said the proprietors were in Germany and in London. He knew who they were; but he could not disclose their names, as he had given his word not to do so. He had let rooms to the Company. He had sold them raw fabrics, as well as impregnated; he could not say it was 20,000 or 100,000, or how many. Since Dec. 4 he had bought chemicals which he dissolved. There was no monopoly in chemicals; what he used them for was his own business. He bought them to sell again; and he did not ask his customers what they were going to do with them. He had bought thorium, ether, collodion, and other chemicals. He had sold thorium, and also cerium, to the British Manufacturing Company. He knew the Morning Sunlight Company. It had now ceased to exist; but he could not say when. He was not one of the proprietors, and could not state who they were. Before the injunction, he sold them fabrics; but not chemicals. He sold them a solution containing ether, collodion, and oils, but not thorium or cerium. He knew the Universal Incandescent Company, who carried on business at 8, Aldgate Avenue. Mr. Mundler was the former owner. He could not give the name of the present proprietor, though he knew him; the plaintiffs must find out for themselves. He had sold impregnated fabrics to the Company since Dec. 4, but he could not say how many, as he did not keep any account-books. The British Manufacturing Company sometimes paid him in cash, and at other times by cheques. He did not know whether or not the Company had a banking account. If he knew, he would not say. It was the same with regard to the Universal Company. He did not think they had a banking account. He had none himself. The cheques he received he paid away again, or had them changed. He knew Mundler, who formerly traded under the name of Bettelheim. He also knew S. Liebermann and Joseph Altmann; but he had not spoken to them recently. He was formerly in their employ at Mansel Street, and when he left them to start for himself, they were annoyed with him as a competitor. They carried on business as the New Evening Sunlight Incandescent Company. He left them in September. He knew now that an injunction was granted against them in June. In November, 1896, he made an affidavit in which he swore that in the previous June the plaintiff Company obtained an injunction against Liebermann and Altmann; and after that, they, without his consent or knowledge, substituted his name for theirs in the conduct of the business. When he found they were thus using his name, he left them, and went to No. 61, Wiesbaden Road, Stoke Newington, N., and began dealing in mantle fabrics, fluid, and other articles. He also burned off mantles, and treated them with collodion. He did not see that he was obliged to say how he made the mantles; there were various ways. He used thorium and cerium. He had sold impregnated fabrics since the previous Tuesday, but not complete mantles. He could not say how many. He remembered Barnett coming to see him on the 10th of January; but he could not remember whether or not he showed him over the premises. It was Sunday, and people would not be at work. He bought and sold for cash, and did not keep any books, except one for his private expenses. On being further pressed, he admitted that he had burned some books about three weeks ago. Some of the documents produced by the witness Barnett on Tuesday were then put before him, and he admitted that they were in his handwriting. He then went on to attack Barnett's character. He knew that within the last two days Mundler had endeavoured to get Barnett arrested for stealing letters; but the police would not take the charge.

Justice ROMER, at the conclusion of the cross-examination, said he would now hear anything the respondent had to urge why he should not be committed.

Defendant said he wanted to cross-examine Mr. Barnett.

After a short discussion, his Lordship allowed this, though the witness had already been cross-examined by Mr. Buckmaster. The so-called cross-examination, however, came to nothing.

Defendant then addressed his Lordship in his own behalf; the purport of his argument being that the plaintiffs' patent only applied to the complete mantle ready for use, and that anyone was at liberty to sell either the raw fabrics or the materials for making mantles. In conclusion, he said he would do whatever his Lordship declared to be right.

Justice ROMER said in his opinion this was one of the gravest cases of contempt that ever came before the Court. The defendant had, with perfect knowledge and understanding of the injunction granted against him, entirely disregarded it. So bad was the case, in fact, that his own Counsel, who appeared for him originally, felt obliged to throw it up. But, in order that the defendant might not be prejudiced, he (Justice Romer) gave him an opportunity of addressing the Court, and of doing anything he could to try and escape from the consequences of his acts. He was sorry to say that he had added to his misconduct by giving untruthful evidence in the box; and in such a gross case he felt bound to assert the dignity of the Court. He should therefore order him to be committed for one calendar month for contempt, and to pay the costs of the motion.

The tipstaff, who was in attendance, immediately arrested defendant.

Mr. TERRELL said the infringement was still going on, and a large number of persons in the position of servants and workpeople were concerned; and though the plaintiffs had no wish to be harsh, they would be compelled to proceed against them if necessary.

Justice Romer said it would be no excuse for anyone who knowingly committed a breach of an injunction granted against any person, his servants, or agents, that they were acting under his orders. They would be equally liable to be committed for contempt of Court.

Friday, Feb. 19.

In re the Incandescent Gas-Light Company's Patents.

Several motions in which the Incandescent Gas-Light Company, Limited, asked for injunctions against infringers of their patents, or committal orders for breach of injunctions or undertakings, came before his Lordship to-day.

Mr. Moulton, Q.C., appeared for the plaintiffs in the first case, which was against the Royal Incandescent Light Company. There was no appearance on behalf of the defendants; and the purchase of an infringing mantle having been proved, the usual order was made.

In the next case, against the Aurora Company, Mr. Moulton appeared for the plaintiffs and Mr. Buckmaster for the defendant. This case had been adjourned; an objection having been raised, when it was first brought on, that the only infringement proved was after the issue of the writ. There was now evidence of the purchase of a mantle before such issue, and of its analysis. The only point raised for the defendant was that the evidence of Mr. Gutch as to the preservation of the mantle and its identity with the one handed to Mr. Ballantyne for analysis on the 8th inst., was not sufficiently specific. No evidence, however, had been filed in opposition; and therefore the usual order was made.

In an exactly similar case against the American Incandescent Gas-Light Company, in which Mr. Buckmaster also appeared for the defendant, he said he could not resist an order after his Lordship's decision in the previous case. He should advise both his clients to put an end to the matter by submitting to a perpetual injunction.

Mr. Moulton then moved for a writ of attachment against Mr. S. Benjamin, of Mile End Road, for breach of an interim order which had been made against him. There was no appearance on behalf of the defendant; and all necessary formalities having been duly proved, his Lordship directed a writ of attachment to issue.

Mr. Terrell, Q.C., then moved for the committal or attachment of Mr. W. Marsden, for breach of an undertaking given by him in Court on the 18th of December last.

Mr. W. Crowther Davies appeared for the defendant, who had made an affidavit to the effect that he was away from London at the time the sale was alleged to have been made; and that such sale, if made, was contrary to his orders.

Mr. Terrell said he had not seen this affidavit; and he applied for the motion to stand over for a week.

The application was granted.

Saturday, Feb. 20.

In re the Incandescent Gas-Light Company's Patents.

Several cases came before the Court to-day upon motions for judgment in default of appearance. The plaintiff Company alleged infringement of their patents of 1885 and 1886, and claimed injunctions, delivery up of the infringing articles, and payment of costs as between solicitor and client. Orders were made against the following defendants: Jarratt, Winter, the Albo-Incandescent Company, Glensnick and O'Donnell, the Venus Incandescent Light Company, and the Metal Patent Syndicate.

Wholesale Waste of Water at Salisbury.

The Salisbury City Council have taken a sensible step in their efforts to check the abnormal consumption of water, which is believed to be principally due to the leakage caused by defective fittings for which private owners are responsible. John Bryant Young, a builder, has been a big offender in this way; and he was recently called before the City Magistrates on five separate charges of having negligently allowed water to run to waste in water-closets attached to certain houses belonging to him. In one case, the fittings were in such a bad state that the water ran to waste (according to the way in which the handle was put down) at the rate of from 30 to 250 gallons per hour; and in another instance, from 250 to 300 gallons per hour was being wasted. During the past twelve months, no less than 62 written notices were served on the defendant, and several verbal notices had been given to him. On a moderate calculation, the city was put to an expense of something like £17 last year over his water-fittings; and he has caused similar trouble during the past ten years. The Bench gave a distinct indication as to their views on the matter by fining defendant a total amount of £10, and threatened that if any similar cases came before them, the fines would be more severe.

Gas-Works Extensions at Keighley.—The Keighley Town Council lately decided to apply for borrowing powers to the amount of £9800 for the extension of their gasholder accommodation. Last Tuesday they resolved to increase the sum to £10,600.

The Gas Poisoning Case at Leamington.—Householders should be warned of the danger of neglecting loose gas-taps. It seems that the death of Mr. Richard Green, the American gentleman who was visiting Leamington (as reported last week), must be attributed to this. The circumstances connected with the fatal event were these: Deceased, who was 50 years of age, and had spent 32 years of his life in America, was staying with his sister (Mrs. Sarah Hawthorne) at Leamington. As he did not appear at the usual time on the morning of the 13th inst., his sister went to his room, where she found her brother breathing heavily, and a strong smell of gas pervading the room. The gas-bracket tap (which was loose) was partially turned on, allowing the gas to escape. Mrs. Hawthorne at once shut it off, and opened the window. Every possible step was taken to restore deceased, but without avail—his death taking place two or three hours later. The jury returned a verdict of "Accidental death, caused by gas poisoning." It is stated that Mr. Green had previously met with an accident by which he had been deprived of the sense of smell and taste.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held at the Bridge House Hotel, London Bridge, S.E., last Wednesday—Mr. George Livesey in the chair.

The Secretary (Mr. Frank Bush) read the notice calling the meeting and the minutes of the last meeting; and the report of the Directors was taken as read.

The Chairman, in moving the adoption of the report and accounts, observed that the report gave as full and succinct an account of the affairs of the Company as it was possible to do in so short a compass. The figures spoke for themselves; and the various paragraphs dealt with the salient matters which had affected the Company during the past half year. The first paragraph was, perhaps, the most interesting, because it spoke of the continued prosperity of the Company. It referred to an increase in the consumption of gas of 10 per cent. over the corresponding period of the preceding year—an increase amounting in money to about £43,000. It was necessary, however, to correct an assumption sometimes made—namely, that this increase of revenue was all profit. It was nothing of the kind. The report stated that only about £10,000 of the amount was profit; but this was rather understating the matter, though certainly not more than a third—rather less—could be taken as profit. With respect to the way in which the increase was made up, he found that it might be divided into about three equal parts. A trifle more than one-third was due to the increased receipts from the penny-in-the-slot meters—the prepayment consumers, of whom they had 14,000 more in the last half year than in the December half of 1895. They also had 3386 more ordinary consumers than they had twelve months ago. These new consumers and new stoves accounted for certainly another one-third of the 10 per cent. increase. What was even more satisfactory, perhaps, was that the old consumers had also increased their use of gas; and to this fact nearly one-third of the increase was also due. He regarded this as exceedingly satisfactory. The next paragraph in the report could certainly not be viewed in the same light. It dealt with the question of coke and ammonia; they had never known the markets for these products to be in so bad a condition. He was afraid, too, that he could not hold out any hope of improvement—at any rate, none was apparent yet. They were making large quantities of coke, but they were obliged to sell at very low rates; as to ammonia, it was still realizing the lowest price practically that it had ever reached. This meant a very serious loss to them. If they had had the same prices for coke and ammonia as they had received two years ago, it would have been equal to over 3d. per 1000 cubic feet of gas. This affected the consumers very materially. Tar was also not doing so well, and especially pitch. This was one of the principal products from tar; and was used largely as fuel. The most valuable products from tar were those used for the production of colours. This was formerly an English trade. Just before the sixties, Dr. Perkin, F.R.S., associated with Dr. Hoffman, discovered a method of producing aniline dyes from tar. It was an English invention, worked in England for a time, but now completely gone to Germany. This had seriously affected all gas consumers in this country. He calculated that by the tar business being taken out of this country, there had been a loss to English consumers of £500,000 a year—that if our manufacturers had but retained this colour business, tar would have been sold at better prices, the users of colour would have paid no more for the article, and the consumers would have saved in their gas £500,000 a year. The next paragraph of the report was also an unsatisfactory one—referring to the rating. The paragraph dealt with the matter at length, and he therefore would not go into it in detail; but he might say that every five years there was a reassessment of the Company's property. There were certain rating surveyors, who tried to put the value as high as possible. They had to appeal to the Assessment Committees; and he was glad to state that the principal Committees—those of all the large urban parishes, including Lambeth, Camberwell, Newington, St. Saviour's Union, St. Olave's (with Bermondsey), and Rotherhithe—listened to what the Company had to say. The year 1894 was an exceedingly good one; and that was the year taken as the basis for the rating for the next five years. The Company pointed out that it was not fair to take an exceptionally good year as the basis, because they had reduced the price of their gas, and had already got rid of the surplus profits of that year; and they also stated that coke and ammonia had materially fallen in value. The large parishes attended to their representations, and though the Company had to agree to a considerable increase in their rateable value, still there was a spirit of fairness shown to them. The suburban parishes, however, would not take this view. It was singular that it was always the suburban parishes, which could not be supplied with gas so cheaply as the others, who took the opposite view, and would not listen to what the Company had to urge. They had, therefore, been obliged to appeal to Sessions. This was not a matter that would affect the shareholders by a halfpenny, for they were not paying full dividends. They proposed to pay 5¼ per cent.; but they were entitled to 5½ per cent. If, therefore, the extra rating should necessitate a rise in the price of the gas, they could make the increase without reducing their dividend at all, and the whole of the extra cost would be thrown on the consumer. But another question arose in connection with this matter. They wished to do what was fair all round. It would not be fair to raise the price in the parishes which had dealt fairly by the Company, in order to make up the loss due to the action of the other parishes; but it had occurred to them that it was quite practicable for them to charge a differential rate—that they might charge a higher price for gas in the parishes where they were rated higher, and leave the other parishes at the lower charge. They would be very sorry to do this; but the worm would turn sometimes. Last session, a Royal Commission was appointed to inquire into all questions of rating; and seeing that gas, water, and railway companies—all public companies—had to complain of the present exceedingly unsatisfactory system, he thought it desirable to show the Royal Commission the absurdity and the difficulty of assessing public companies under the present system. They also wanted to make those who had control of the public authorities—the voters—feel the incidence of the rates they

paid indirectly. If they did this, they would not be so ready to acquiesce in an increase of the rates. The last paragraph of the report dealt with the profits. The Directors would have been very glad to present a statement of account showing a larger amount of profit; but they thought, under the circumstances, the profit realized in the half year might be considered satisfactory. They had earned within £1200 all that they required to pay the dividend of 5½ per cent., which was a trifle more than they paid last time, when the distribution was equivalent to £5 4s. per cent. They did not stand alone. Other gas companies had found the same difficulty; and considering their enormous loss on coke and ammonia, he thought it was very satisfactory that they had been able to meet the dividend as closely as they had done with their price of 2s. 3d. per 1000 cubic feet. The regret of the Directors was that they were not able to add to the reserve fund this half year. The fund stood now at £93,000 odd, but they would like to see it increased to £150,000, and they hoped it would be in time. The shareholders, however, must not imagine that it would be possible for them to do two things at once—to increase the reserve fund and also the dividend—for they were only allowed to increase the reserve fund out of divisible profits. They therefore wished it to be clearly understood that, while they believed there would be no reduction in the dividend—because they could raise their price without reducing the dividend—still the shareholders must not get the impression that there was to be an increase in the dividend shortly. They desired a larger reserve fund. The £1200 which they would take out of the undivided balance, would reduce that amount to about £1300, so there was not much left. He thought, however, that in the present half year they might assume that they would at any rate earn their dividend. The Directors felt on these occasions that it was due to the proprietors to give the latter an account of their stewardship, as it were, and to lay before them the policy governing the Board in their management of the concern. If they did not agree with the policy the Directors were following, it was open to them, when they came up for re-election, to express their dissent by proposing the appointment of someone else. Happily, no one had done this yet. Still, they felt it to be their duty to state they were following a policy different from any other gas company in the kingdom—at least, there was only one other Company, the Crystal Palace District, who were doing the same. They had adopted the system of making their new issues of stock to the consumers, to whom they had just issued nearly £50,000 at 140, which would pay about 3¾ per cent. on the investment. Another point arose in connection with this matter. When people were paying such a high price for their stock it would be a serious thing if they reduced the dividend by raising the price; and investors might complain that they had not behaved fairly in such an event. They sent the circular offering the stock he had just mentioned to every consumer. They received over 1100 applications; and as they wished particularly to favour the small investor, they were obliged to cut down considerably the larger amounts that were applied for. They could not give anyone more than £80 of the stock; and the greater part of the applicants had only £50 or less. A very large number of them applied for small amounts. Of the 1120 applicants, about 220 were old shareholders, who applied for additional amounts; leaving about 900 new shareholders who had come in. The number of shareholders they had at present was a little over 7000. Of these, more than 3600 were consumers, and rather over 700 were employees of the Company; leaving their ordinary shareholders under 3000 in number. The Directors felt it was right that this information should be given to the proprietors. The course they adopted increased the office work; but did it meet with the approval of the shareholders? If the proprietors asked the Directors' opinion, and if it was requisite to defend their action, they would contend that it was a wise course to adopt, because it was necessary to secure friends. Hitherto gas companies had had a very secure business; and they had not tried to make friends as they might have done. They needed friends—they needed them badly—and he was afraid that they were suffering to some extent from the very circumstances of their business. They were monopolists, not of light, but of the supply of gas; and the very name of "monopolist" created a prejudice at once. They were endeavouring to do their business in a fair and honest manner; and they were also trying to make friends among their consumers and their workpeople in every way they could. They were bound to look after the consumers because, apart from those who were shareholders, they were all practically, under the sliding-scale, partners with the Company. With every improvement made in the supply of gas, six-sevenths of the saving went to the consumer. On the other hand, if coal or anything went against them, if they lost money on the products, or if any other circumstance increased the cost of manufacture, the consumer had to pay six-sevenths of the additional expense. Of these sleeping partners they had over 150,000; and they wished to protect their interests simply because they regarded them as partners. What they were doing in connection with the rating question they were doing, not for the sake of the shareholders, who would not be affected if the rates were put up a great deal, but for the sake of the consumers. For the protection of the latter, therefore, they were endeavouring to obtain what they considered justice. It was true that, in their policy of making friends, they stood alone—other gas companies did not do the same; but it did not follow because they stood alone that they were in the wrong, and that the other companies were in the right. It was just possible everyone else might be wrong, and their own Company right. They had endeavoured to conduct their business in such a way as to gain a reputation for fair dealing. They had contended for many years that, if the British public were dealt with fairly, they would appreciate it. It was impossible to do absolute justice to everyone; but when it was known that that was the desire and intention, it was appreciated. He thought that the goodwill manifested towards the Company by their customers was due to some extent to what they had endeavoured to do for them for many years. Capital was in a rather precarious position just now; it had very few friends outside the ranks of the capitalists. In order to protect capitalists, they wanted to enlist on the side of capital a large proportion of those who would otherwise be against them. This was the principle which had led them to induce their workpeople—and with great success—to become shareholders in the Company. When once they became shareholders, they had left the ranks of the "have nots" and joined the ranks of the "haves"—they had parted from the enemies of capital and joined its friends. On this ground they defended the principle they had acted upon in this matter. They wanted so to conduct their business that the public should appreciate them. It was all very well to adopt measures of sharp practice; but such actions did not answer in the long run. The poet, referring to the brook, had said—

"Men may come and men may go,
But I go on for ever."

The same might be said of a company. An individual firm might carry on work, make a fortune, and retire; and there was an end of it. But a company went on; and their desire was to establish such a reputation that their successors should retain the goodwill of the public.

Mr. Robert Morton seconded the motion.

Mr. W. B. Jeffries said that the remarks of the Chairman were very encouraging, except with regard to the rating. It was a very serious thing for a proprietor to hear that the cost of the increased assessments was £18,000 a year to the Company; for it would prevent the Directors from reducing the price of gas so quickly as they would like to. He urged them to go on with their appeals. With respect to the repair and renewal of stoves, he presumed that this was in reference to the gas-stoves. (The Chairman: Yes). It was a very serious item—amounting as it did to over £14,000 a year. Would the Board consider the advisability of holding out inducements to the users of these stoves to purchase them, and thereby lessen considerably the sum in question? He thought that in the next balance-sheet the item of "Directors' allowance" might be altered to "Directors' fees." He also wished the Directors to consider the advisability of giving them a list of the investments in which the various reserves were put.

Mr. Soden said he regarded the question of rates and taxes as a very serious matter. The Directors were justified in taking all the steps they could to get the item reduced; and their efforts in this direction would, he was sure, be cordially supported by the shareholders. It appeared to him as if the local authority said: "Here is a Company with a parliamentary monopoly paying a substantial dividend; and it will not matter if we rate them on their profits." It seemed to him that the authorities had taken the measure of the Company's prosperity as the basis of rating them; and this was not only an erroneous course, but was illegal and unfair. The basis of their prosperity was good management. It was owing to the proper working of the sliding-scale, of which the Chairman was the author, whereby the consumers were made partners in the concern; and it was also due to the further policy of the Directors—adopted at the time of the strike—of enlisting the sympathies of the workpeople, and making them partners in the concern. If they were rated because they were prosperous, and if their prosperity was through the good management of the concern in which their workmen had an interest, the rate to a great extent became a tax on labour. The low price of residuals was regrettable; but this was one of the risks which attached to their business. If the local authorities were in any way right in regarding the profits of the Company as the basis of rating, it seemed to him that, in view of the low price of residuals, a very large substantial percentage by way of reduction should be made on this ground.

A Shareholder stated that, in issuing the new stock to the consumers at 140, an advantage had been given to them over the market value.

Another Shareholder moved a resolution expressing entire accord with the action taken by the Board in connection with the rating, &c.

The Chairman, in reply, said it was hardly necessary to propose this resolution. The question before the meeting was the adoption of the report; and the point referred to by the gentleman who last addressed them was really included in it. The Directors stated in the report that they were appealing against the assessments; and if the shareholders adopted the report, they would really be adopting the suggestion of their friend to whom they were much obliged. In reply to other remarks, the Chairman stated that they sold all the stoves they could; but they found that people would rather hire than buy them. The form of their accounts was prescribed by the Board of Trade; and they called the Directors' fees "Directors' allowance." It was the same with The Gaslight and Coke Company and other gas companies supplying London. Any shareholder, by going to the Secretary, could see the list of their investments; but he might state that their reserves were very largely invested in Consols. If not in Consols, they were in the very best securities they could get; the nature of which might be gathered if he stated that they only yielded a return of 2½ per cent. In settling the price of the stock recently issued to their consumers, they had to fix the reserve price last November, when the Money Market was in a very ticklish state. The Bank-rate had then just been raised; and immediately before this the Directors had offered debenture stock for sale at the market price, when not one-third of it was applied for. It was true that they ultimately obtained the reserve price for the rest, but with some difficulty. It was necessary for them to place the new stock, the price of which, taking off the dividend, would be 142. Feeling that they had rather failed in connection with the issue of debenture stock, the Directors fixed the price at 140. No dividend would be paid on the stock until Sept. 1. They endeavoured to obtain the best price they could, and they had placed the stock; and in this way they had obtained 900 more friends.

The motion was then put, and carried unanimously.

The Deputy-Chairman (Captain T. B. Heathorn, R.A.) proposed the payment of the dividend recommended.

Mr. E. H. Cardwell seconded the motion, which was carried.

Resolutions were afterwards passed re-electing the retiring Directors (Messrs. Ewart and Morton) and the retiring Auditor (Mr. Mortimer).

The Chairman afterwards proposed the following resolution: "That the Directors be and are hereby authorized to raise the sum of £250,000 further capital by the issue of ordinary stock and debenture stock, in such amounts, at such times, and in such manner as they may deem desirable, pursuant to the powers contained in the Company's Acts of 1882 and 1896." He was, he observed, rather sorry in one sense to propose such a resolution; but he was glad in another. He was sorry that their capital had to be increased; but he was glad that business increased in such a ratio as to necessitate it.

Mr. Simpson Rostron seconded the motion, which was carried.

An Extraordinary General Meeting was then held to consider the Company's Bill in Parliament for altering the qualification of the Directors.

The Solicitor (Mr. Blyth) read the heads of the Bill, which, he stated, was simply an amendment of two sections of the Act passed last year. It was proposed to make the qualification of the Directors other than the

Employee Directors the possession of stock of the nominal value of £2500. The Act passed last year fixed the qualification of Employee Directors at £250; and this it was proposed to alter to £100.

The CHAIRMAN, in proposing a resolution approving the Bill "subject to any amendments which may be made therein by Parliament and approved by the Directors," reminded them at their meeting last year the proprietors approved of their Bill dealing with various questions—the conversion of the capital, the appointment of Employee Directors, and certain other matters. In the Bill, the qualification for Employee Directors was fixed at £80 of stock. The House of Commons Committee before whom the Bill came, without any suggestion from anyone, took it into their heads to alter this £80 to £250. They tried to explain to the Committee that this would be prohibitory—that £250 of stock meant £370 of money, and that it would be impossible for an employee in any reasonable time to save such an amount. The Committee, however, were obdurate. He saw one or two leading members of the House of Lords, who were quite prepared to move an amendment in the Upper House. But the Chairman of the House of Commons Committee said that he would not agree to any change; and that if the Bill came back with any alteration from the Lords, he would move that it be not accepted. The Directors did not intend to run any risk; and having obtained the conversion of the stock, they thought they had better take what they could get. What the Directors proposed by the present Bill was to restore the qualification of the Employee Director more to what the shareholders agreed to a year ago; but instead of saying £80, they now proposed the round figure of £100. This meant that before any employee could be qualified for the position of a Director, he must have £150 in the Company. The qualification of an ordinary Director in the Act of last year was put at £5000, which meant £7000 or £7500 in money. They found that they had very few shareholders who possessed such a qualification—about 60; and they would probably have discovered, on sifting the matter further, that out of these 60 only two or three were eligible or able to serve. They therefore thought it best to reduce the qualification of an ordinary Director to £2500. In other companies, the qualification was usually about £1000.

Mr. J. MEWS seconded the motion.

Mr. W. B. JEFFRIES dissented from the proposal. Workmen Directors, he contended, would not be able to come from the yard to a seat on the Board and discuss questions freely.

A SHAREHOLDER: That is not the question we have to consider now.

Mr. JEFFRIES (continuing) said the proposal would give the Chairman increased voting power.

The CHAIRMAN stated that the Act limited the number of Workmen Directors to three, while there were seven other Directors. The House of Commons Committee altered the qualification of a Workman Director from £80 to £250; and all that the Directors proposed in the Bill was that the amount should be £100. He must protest against one remark of Mr. Jeffries—that he (the Chairman) would elect the Workman Directors. They would be selected by the shareholding workmen, and by ballot. The scheme was to be approved by the Board of Trade, who would never sanction an arrangement which would place in the hands of any Chairman the power of being able to pack the Board.

Mr. STOCK remarked that Mr. Jeffries' observations were really against the resolution which the proprietors passed at their meeting a year ago, and also at their meeting in the preceding August.

Mr. TITTERTON said he would move an amendment to the effect that the qualification of Workmen Directors should be not less than £250.

Mr. HOBSON seconded it, and afterwards argued against the principle of Workman Directors.

The CHAIRMAN, in reply, stated that the Solicitor had informed him that the Directors could not take what was proposed as an amendment—it must be dealt with as a negative.

Mr. EWART, as a member of the Board who had been, perhaps, most active in opposing the Chairman's policy of having Workmen Directors, said he thought that the Board were unanimously in favour of what was now proposed. It was felt that a reduction in the qualification of the ordinary Directors would widen their area of choice; and the same remark would apply to reducing the qualification of the Workmen Directors.

The CHAIRMAN, in further reply, stated that none but their own workmen could be Directors. There was practical unanimity that the right course was to induce their workmen to become shareholders in the Company. He had already explained that the shareholders were capitalists, and that capital had a great many enemies. What he had been endeavouring to do was to reconcile capital and labour; and if they could make their own workpeople the friends of capital, they could snap their fingers at everyone else. What was proposed by them was exactly the opposite of Socialism. They had a few employees who had £250; but that had been left to them, or it had been the savings of a lifetime. They felt that they wanted a larger number to select from than the £250 qualification would give them. They might depend upon it that their workmen were shrewd enough to know who were the most suitable men to represent them on the Board. When the scheme came to be put in force, it would only last for three years. If the employees selected capable and honest men, it would be a success; but if not, the scheme would fail and lapse at the end of the three years.

The motion was then put, and carried on a show of hands.

Dr. DRYSDALE proposed a hearty vote of thanks to the Chairman and Directors.

Mr. HOBSON seconded the motion, which was carried.

The CHAIRMAN, acknowledging the vote, assured the meeting that the Directors only had the welfare of the Company at heart; and they would endeavour by all means in their power to promote its prosperity. He afterwards proposed a vote of thanks to the Engineer, the Secretary, the staff, and workmen, to the value of whose services he cordially testified.

Mr. JEFFRIES seconded the motion, which was carried.

The CHIEF ENGINEER (Mr. Frank Livesey) and the SECRETARY acknowledged the vote; and the proceedings then terminated.

Extensions at the Accrington Gas and Water Works.—At a meeting of the Accrington Gas and Water Board on the 11th inst., it was announced that the Local Government Board had sanctioned the application for power to borrow £61,425 for extensions at the gas-works and the construction of a new reservoir and filter-beds.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held last Friday, at the Albion Tavern, Aldersgate Street, E.C.—Mr. GEORGE LIVESEY presiding.

The SECRETARY (Mr. Charles M. Ohren) read the notice calling the meeting. The Directors' report and the accounts—the principal points of which were published last week—were taken as read.

The CHAIRMAN, in proposing the adoption of the report and accounts, said he thought there was not much that one could add to them. Those who followed the history of the Company and kept the reports from time to time, would be able, by reference, to see what progress had been made. In the present report the Directors alluded to the salient features of the working during the past half year; and the most prominent and interesting one was the large increase in the quantity of gas sold. It was the case with many other gas companies that in the half year there had been a considerable increase over the corresponding period of 1895. Possibly to some extent this was owing to the improvement in trade; but the larger part of the increase was due to the great development of gas consumption in workmen's dwellings by means of prepayment meters. He found they had raised the number of these working-class consumers from 3146 in December, 1895, to 5005 in December last, or an increase of 1859. These consumers would burn perhaps 13 or 14 million cubic feet of gas in the half year; and, as the total increase in the consumption was 40 millions, one-third was therefore due to the new consumers, and two-thirds to the old and new ordinary consumers and also to the growing use of gas-stoves. It was to these increases that they must look for reductions in price. The Directors were not satisfied with the charge of 2s. 7d. It had been down to 2s. 6d.; and it would be a great satisfaction to them to return to that again, or even a lower figure. He noticed in their last issue that the "JOURNAL OF GAS LIGHTING" were adopting the American style of sensational head-lines. One of their leading articles was headed "The Cheapest Gas on Earth." He thought this was something extraordinary; and when he came to read the article, he found it referred to Widnes. There they had a very capable Manager; and they had succeeded in reducing the price of gas to 1s. 6d. per 1000 cubic feet to large consumers, and to 1s. 8d. to smaller ones. This was due to the ability of the Manager, and to the wisdom of his employers in giving him a free hand. The name of Isaac Carr ought to be mentioned in this connection; and in his footsteps they would be glad to follow so far as they were able. He (the Chairman) might here say that the increase in the Company's business during the past ten years had been just 50 per cent.; and during the last five years, close upon 25 per cent., which meant about 5 per cent. per annum—not compound. With regard to the expenditure of the half year, he did not think it necessary to say much, except that some of the items were at about the same rate as, and others were lower than, in the corresponding half of 1895. For instance, the cost of coal now was 12s. 10½d. per ton; while in the December half of 1895, it was 12s. 11d. Carbonizing wages worked out to 3s. 1¾d. per ton in 1895, as compared with 3s. 0½d. in 1896. The salaries of the engineer and officers at the works averaged 4½d. per ton, against 5¾d. in the second half of the previous year; the difference being due to the charges being spread over a larger amount of coal. The distribution expenses were 2s. per ton, as against 2s. 5d. But rates, he was sorry to say, in this Company as in many others, had gone up; the addition in their own case having been £735—they were £2144 in the December half of 1895, and £2879 in the past six months. This was a considerable increase; but they must not complain, as they had got off better than some of the other companies. Still it was a serious item, and amounted almost exactly to the advance in the profit. The increased profit was £789; whereas, if the rates had not gone up, it would have been about double. However, in December, 1895, there was a deficiency of £1438, and in June, 1896, of £1946; but, happily, last half year it was only £572. They were overhauling the deficiencies; and the improvement was due he thought partly to certain small economies, but mainly to the large increase in business, which he hoped would continue—perhaps not at the rate of 9 or 10 per cent., but, if it were maintained at a moderate rate, they would have no cause to complain. The report also dealt with another exceedingly interesting subject. By their last Act of Parliament, the Company were authorized to offer their stock to the consumers; but, first of all, it had to be submitted for sale by tender. They advertised it in accordance with the Act, and obtained very few tenders indeed at the reserved or market price. They were then entitled to offer it to the consumers at the reserve price. The applications were far more numerous than they anticipated. Some of them were for large amounts; but the object of the Directors in offering the stock to the consumers was to spread the area of the Company over as large a base as possible. If, for instance, the whole of the property of the Company was in one man's hands, it might be described as a pyramid on its apex; whereas if it were distributed over the whole of the consumers, it would be no pyramid at all, but an enormous base, at one uniform level. Well, the report said the stock was applied for three times over. The Directors had to reduce the larger amounts; and, in the end, they had introduced 170 new shareholders, holding small sums. The maximum, he believed, was £200; and the great majority were under £100. This, of course, increased the amount of the book-keeping, and was a distinct departure from the usual policy of gas companies. The general policy seemed to be to get the capital placed in as few hands as possible. He would, on this occasion, like to make clear to the shareholders the course the Directors were adopting in this matter; so that they might understand perfectly what was being done. The Board were of opinion that the more they could spread the holding among the consumers, the better it would be. They thought that every consumer who became a shareholder would necessarily be friendly inclined towards the Company, and would say a good word for them when opportunity afforded; whereas, if he were not a shareholder, he would at the best care nothing about them. The Directors had pursued this policy in another direction; and this was a matter that ought also to be explained to the shareholders. They had come to the conclusion that it would be to the advantage of the Company if the employees were shareholders. He might perhaps be allowed to say that, in his connection with the Gas Company with which he had been associated all his life, he had taken a deeper interest in it because he began investing his

savings in it, and so became a shareholder. The Directors had adopted the policy of giving every encouragement in their power to the officers and employees of all ranks to become shareholders; and he was glad to report that they had to a large extent availed themselves of the opportunity. Under the profit-sharing system, the officers and workmen had agreed that one-half of their annual bonus should be invested in stock; and it was left optional to them to invest any other sums they cared to so dispose of. This had only been in operation two years; and altogether about £3000 had already been so invested. This was quite a new departure; and there was so far only one other Gas Company doing the same thing. There was another point in connection with this subject, upon which he must give a little explanation. Many years ago, he heard of a negro (whether it was true or not he did not know) who refused to say "A." Asked why, the negro said: "If I say 'A,' I shall have to say 'B' next; and I do not want to go on in that direction." Having adopted this policy of inducing their workpeople to become shareholders, something more would follow, but not yet. The time would come, if the men continued to invest as the Directors had every reason to suppose they would, when they would share not only in the risks of capital, but it would be right that they should also share in the responsibilities of its management; and then it would be fair and necessary that representatives of the employees should sit on the Board. This was perhaps a startling proposition to make; but he thought it only right that the shareholders should be told what this first step might lead to. If they encouraged the men to invest their savings in the stock of the Company, they would in time hold a considerable amount; and it would be impossible to resist representation or some responsibility in the management. However, no such proposal would, he expected, be made for a long time; but he mentioned it, as there was no doubt it would come. It had been said to him (Mr. Livesey): "How would you like such a man as the Secretary of the Gas Workers' Union on the Board?" He replied that there was no danger of him becoming a shareholder or an employee of the Company; but one might have a worse man than he once was. He was at one time employed by the South Metropolitan Gas Company. It was true he was a Socialist; but still he (the Chairman) had a sneaking liking for him. He believed he was altogether mistaken; but he was honest and brave. If the Company could get representatives of their workmen who would come on their side, it would be a strength rather than a weakness to the concern. This, however, was a digression for which his colleagues were not in any way responsible. ["Hear, hear," one or two members of the Board laughingly exclaimed.] There was another thing they were doing in connection with their employees. In the revenue account was an item of £470 for the workmen's sick and superannuation fund. The men contributed a certain sum each week to the fund, and the Company an equal amount for times of sickness, and another fund was for pensions, when the men were worn out. He was sure his colleagues agreed with him entirely in this matter. He did not think because they were a Company that they ought to shirk the responsibility of employers. The private man considered his employees had a claim upon him; and because they were a Company, there was no reason why the same claim should not stand. The shareholders, he believed, would also think it a right and proper thing that, in conjunction with, and by the co-operation of, the men, if the latter contributed their part to this fund, the Company should add to it to encourage them to make provision for distress and when strength failed in old age. (Applause.) He was glad to have this token of approval, because it showed that the shareholders were not the mercenary people they were often considered to be, but had the feeling of humanity in common with the rest of the species.

The DEPUTY-CHAIRMAN (Mr. Frederic Lane Linging) seconded the motion.

Mr. J. H. CHECCUCCI said he was one of the new consumer shareholders; and he thought the Directors had acted wisely in the course they had taken. He had about 100 houses close to the gas-works; and the people had to get his sanction before they could have the gas laid on on the prepayment system. Now, he had more interest in the concern than previously; and he wished to encourage the Directors in their new departure. He was glad to hear what had been said in regard to the workpeople.

Mr. WOODS (also a new consumer shareholder) said it seemed to him from the figures in the accounts that about one-tenth of the gas manufactured was unaccounted for; and it struck him that the proportion was rather large.

Mr. J. B. BISSETT also spoke approvingly of the policy adopted by the Directors in connection with the workmen.

The CHAIRMAN, in reply, said it was a source of much satisfaction to the Directors to find the new consumer shareholders taking such an active interest in the affairs of the Company. As to the unaccounted-for gas, in the June half of last year it was 4¼ per cent.; while in the second half, it was 9¾ per cent., which represented an average of 7·15 per cent. for the year. Then it so happened that a Board meeting fell on Jan. 15; and, in order to get a statement prepared before then, the meter indices were taken two days earlier. That was a mistake, as they were two days' consumption short in these accounts, which would have brought the 9¾ per cent. down to perhaps a little above 7 per cent., and the average for the year to about 6 per cent., which would not have been very excessive. The percentages of unaccounted-for gas had gone up generally of late years, since the introduction of cooking-stoves. Before then they were able to supply the day consumption with a very light pressure—8-10ths of an inch at the works—during 15 out of 24 hours; while now they were obliged to work at 1½ inches pressure during a great part of the day, in order to give sufficient gas for cooking-stoves and engines. This was the cause of the slight increase in the unaccounted-for gas.

Dividends at the rate of 5 per cent. per annum on the preference stock and of 5¼ per cent. on the ordinary stock, less income-tax, having been declared,

Two resolutions were passed, on the motion of the CHAIRMAN, seconded respectively by Dr. HETLEY and Mr. C. LEA WILSON, re-electing the retiring Directors (Messrs. James Glaisher and A. T. Layton).

Mr. W. WESTCOTT proposed, and Mr. T. GUYATT seconded, the re-appointment of Mr. Alfred Lass, the retiring Auditor; and the proposition was unanimously carried.

The CHAIRMAN said he had next the very pleasant duty to perform of moving that the Secretary's salary be increased by £100 per annum as from Jan. 1 last. Three years ago Mr. Magnus Ohren retired from the secretaryship; and his son was appointed in his place. He had been in the service of the Company for a great many years, and had worked very zealously. He gave such satisfaction to the Directors that they thought it only right to make this proposal.

The DEPUTY-CHAIRMAN, in seconding, said it was his privilege to be Chairman at the time Mr. Ohren was appointed to his present position. He had known him from his youth up; and he had much confidence in him. He had fulfilled all the Directors' expectations, and had gained their approbation from the time he had held the appointment.

The motion was unanimously agreed to.

Mr. OHREN thanked the Chairman and Deputy-Chairman for the kind manner in which they had spoken of him, and the shareholders for the heartiness with which they had endorsed the proposal. He was sure the increase would not allow him to lose his interest in, or relax his efforts on behalf of, the Company.

On the proposition of Mr. ALFRED LASS, seconded by Mr. GEORGE ENNIS, the Chairman and Directors were cordially thanked for their attention to the interests of the Company; and similar recognition was made of the services of the officers and staff.

LIVERPOOL UNITED GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held last Thursday—Mr. J. BARKELEY SMITH, in the absence through indisposition of Mr. Edward Lawrence, presiding.

The SECRETARY (Mr. P. F. Garnett) read the report of the Directors, in which the latter recommended that a dividend be declared for the half year of 5 per cent. on the ordinary consolidated stock, and of 3½ per cent. on the consolidated 7 per cent. stock created under the Company's Acts of 1865, 1882, and 1886, less income-tax.

The CHAIRMAN, in moving the adoption of the report, observed that it was very satisfactory to know that their business had decidedly improved in the past six months. They reduced the price of gas on July 1 last from 2s. 10d. to 2s. 9d.; and the result showed that they were fully justified in doing so. The increase in consumption during the half year as compared with the corresponding period of 1895 was 4·9 per cent. Since the beginning of the current year, the increase had been still more rapid; and the total to now from July 1, 1896—the beginning of the Company's financial year—as compared with the same period of the preceding year, was 5·7 per cent. The quantity of gas sold during last half year was the largest in the history of the Company. The shareholders would be gratified to know that this was the position of affairs, because, as they know, they had to meet competition of different kinds—the electric light, &c.—in spite of which the consumption of gas went on increasing. Last year they began to supply carburetted water gas. When this system was originally introduced, they went very fully into the whole matter, and came to the conclusion—more particularly in the interests of the consumers than of the shareholders—that they should adopt the most improved method of manufacturing gas. It was not until after the very fullest inquiry that they decided to take this course; and the result of their action had fully justified their anticipations. They intended from the first to supply a mixture, but were not able until recently to do so. As soon as they found themselves in a position to do it, they began to distribute a mixture of the carburetted water gas and their ordinary cannel gas; and since this had been done, during the last three weeks, it had met with very general satisfaction on the part of the consumers. They had had no complaints whatever since this system was introduced; and in order to ensure the proper working of the system in future, they had decided to lay a new main from their works in Caryl Street to Garston. He trusted that from henceforth they would have no further complaints with reference to the gas. There was some little difference between the two; but he thought the system they had now adopted would meet the wants of all.

Sir THOMAS EARLE seconded the motion.

Alderman J. N. STOLTERFOHT said he was very much pleased to hear the Directors had taken steps to remove the objections to the water gas, because complaints had been loud and frequent, especially in Wavertree, and up as far as Garston. Not only were the complaints to the effect that the water gas was detrimental to health; but he could speak to the water gas not possessing the same heating qualities, and of being detrimental to the gas-burners. He could speak especially on the subject of heating, because he had to look after one of the technical classes for cookery at Holy Trinity Schools, Wavertree, where they used a gas-stove. He was informed that though the supply of gas there was ample, the heat from it was very inadequate. The water gas supplied in the past had unquestionaly given dissatisfaction; and he hoped the causes of complaint would be removed before the meeting of the Company in August.

Mr. J. L. BIRKETT endorsed the last speaker's remarks.

Dr. MANIFOLD complained that for the last three weeks the gas supplied in his house had been miserable in quality. On Wednesday, however, it was better; but even then it gave a dirty, disagreeable flame.

The CHAIRMAN remarked that, though he had said the anticipations of the Directors were fully realized, he referred to the cost of the manufacture of the gas, and the advantage which it gave them in other respects. They admitted that, if old burners were used, it would not give the light it ought to do. In every case where they had had complaints, they had sent and altered the burners; and the result was satisfactory. There was a sort of prejudice in existence against water gas; and they thought it desirable to meet the wishes of all in every possible way. It was always intended from the first to supply a mixture, because they believed the mixed gases gave the most satisfactory results. Bad lights often arose from the fittings not being in proper order. With suitable burners, the gas now supplied ought to be satisfactory; and he hoped when the Directors met the shareholders again, the complaints would have entirely disappeared. Alluding to the remarks of Alderman Stolterfoht and Dr. Manifold, the Chairman pointed out that water gas had not been supplied either to the Holy Trinity Schools, Wavertree, or to the neighbourhood in which Dr. Manifold resided. There must in both cases be something wrong with the fittings or service-pipes. It behoved consumers

to see that these were always in order; otherwise it was unfair to the Company to make complaints against them on account of insufficient light. The Company were desirous of giving satisfaction to everyone; and each complaint would receive immediate attention. Replying to a question, the Chairman added that water gas cost somewhat less than coal gas; but it enabled the Directors on the whole to turn out the gas at a lower charge than they otherwise could do. Throughout the whole of the country, wherever additional gas-works had been erected, the system they had adopted was requisitioned. Every engineer had reported in favour of it, and there was no doubt it would be more largely adopted in future. In fact, so far as America was concerned, it was almost universal.

The motion was carried.

The dividends having been declared, the proceedings closed with a vote of thanks to the Chairman and Directors.

BRISTOL GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Friday—Alderman J. W. S. Dix in the chair.

The Secretary (Mr. J. Phillips) read the notice convening the meeting, and submitted the Directors' report, with the accounts, the chief features of which were dealt with in the "Journal" last week.

The Chairman, in moving the adoption of the report and accounts, said they spoke well for themselves. Every shareholder must feel gratified that the Company had done so well, in the face of the value of residuals and of the fact that the price of coke was not in their favour. Anyhow, they had to take things as they were; but the two matters were certainly very serious in the gas world. The report already informed them that the Company were not only able to pay the usual dividend of 5 per cent., but to place £10,298 to the reserve, and to carry forward £12,131. It spoke volumes for the elasticity of the Company that the competition of the electric light had not affected their supply of, or the demand for, gas, even in the districts where the light was most used. Indeed, he was glad to be able to announce that the past year was the "record" one in the history of the Company in the matter of the sale of gas. So much was this in evidence, that the Directors had had to take thought for the future and its probable demands. They had therefore decided to erect a gasholder at Warmley to supply the large and increasing district outside of Bristol, including St. George; and on the other side of the city, a gasholder at Bedminster would enable them to meet the pressure of business in that locality. There was a satisfactory increase in the matter of stoves and prepayment meters. The consumers had been remembered by a reduction of 2d. per 1000 cubic feet. The Company now charged 2s. 4d.; consumers of more than a million cubic feet having a further concession. When he mentioned that 2d. per 1000 cubic feet meant £12,000 to the Company, and that in the last 2½ years reductions to the extent of £36,000 had been made, it would be seen that the Directors had pursued a liberal policy towards their customers. The consumers outside the city boundaries paid more for their gas; but they had benefited also to the extent of 2d. per 1000 feet. He did not like to prophesy as to the Board being able to make a further reduction; but they would be anxious to seize an opportunity of so doing, both in their own and the consumers' interests.

Mr. Medway seconded the motion. He congratulated the shareholders upon the present position of affairs; but he warned them against being too sanguine. He thought the future prosperity depended not so much upon cheaper gas as better light.

The motion was carried.

The retiring Director and Auditor having been re-elected, the dividend recommended was declared.

A vote of thanks was then accorded to the Chairman and Directors.

The Chairman, in responding, said the Company were already supplying a higher standard of gas than their Act required. If the consumers would only adopt incandescent gas-burners, he was sure great satisfaction would ensue. It was true that these burners consumed less gas; but to his mind they gave a light for reading and illuminating purposes superior to that furnished by electricity, which for the former purpose was glaring and trying to the eyes.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Half-Yearly Report and Accounts.

The report to be presented by the Directors of the above-named Company at the half-yearly general meeting next Saturday, opens with an expression of their satisfaction at the working of the undertaking in the six months ending Dec. 31, as shown by the accounts. Compared with the corresponding period of 1895, there was an increase of 22,827,700 cubic feet of gas, or at the rate of 11 per cent.; and the number of gas-meters in use increased as follows: Ordinary, 383, or 6·78 per cent.; automatic, 1665, or 62·64 per cent. The total number of both classes of meters in use on the 31st of December was 10,353; and of gas cooking-stoves fixed and on rental, 1547—an increase of 476 over the corresponding six months of 1895. With the view of improving the supply of gas to Wood Green and the western districts of the Company, new mains, of diameters ranging from 30 to 4 inches, and of a total length of about 5½ miles, have been laid. To meet the outlay incurred on the extension of this and other plant, the Directors have decided to sell by auction £15,000 of "C" stock; being the fourth portion of this stock. The profit and loss account shows an available balance of £8840, from which the Directors recommend the payment of a dividend at the rate of 11½ per cent. per annum on the "A" stock, and of 8½ per cent. per annum on the "B" and "C" stocks. This will absorb £7648, and leave £1192 to be carried forward.

The accounts accompanying the report show that a sum of £22,904 was expended for capital purposes in the past half year; £20,279 of it being for new manufacturing and distributing plant. This brought up to £262,362 the amount laid out at the close of the past year. As, however, only £237,110 had been received, there is an overdraft of £25,252. The sale of 230,314,200 cubic feet of gas for public and private purposes produced £33,918; the rental of meters, stoves, and fittings, £1919; and residuals, £3687—the total revenue being £39,533. The expenditure on the manufacture of gas was £21,428 (coal and oil figuring for £13,352, and coke used in the manufacture of carburetted water gas for £1098); on its distribution, £3169; on management, £1608; and other items made up a total of £29,590—leaving £9943 to go to the profit and loss account. The plant, under the supervision of Mr. W. H. H. Broadberry, has been maintained in efficient working order. There were 11,748 tons of coal carbonized; and 371,017 gallons of enriching oils were used in place of cannel. The quantity of gas made was 248,572,000 cubic feet, of which 234,937,000 cubic feet are accounted for. The quantity of coke produced was 7048 tons 16 cwt., of which 2349 tons 12 cwt. were used in the manufacture of ordinary gas, 1882 tons 3 cwt. for making carburetted water gas, and 2466 tons 4 cwt. were sold. Of the other residuals, the production of breeze was 1197 chaldrons; of tar, 117,480 gallons; and of ammoniacal liquor, 3263 butts. Sulphate of ammonia amounting to 96 tons 7 cwt. was made, of which 33 tons 7 cwt. were sold.

CROYDON COMMERCIAL GAS COMPANY.

The One Hundredth Half-Yearly Report.

The Jubilee Meeting of the above Company will be held to-morrow; and, notwithstanding the deplorable state of the residuals market during the past half-year, the Directors will have a statement well worthy of the occasion to lay before the shareholders. The report opens with an announcement which will be particularly satisfactory. It is that the sale of gas in the six months was 310,401,500 cubic feet, which is an increase of 32,915,400 cubic feet on the corresponding period of last year, or 11·86 per cent. The growing demand for gas for cooking and heating, and the extension of the system of prepayment meters, of which 2300 are now fixed in the district, have largely contributed to the improvement in the Company's business. The receipts from residuals show an increase over the corresponding period of 1895, but not in proportion to the quantity made for sale—the price of sulphate especially having been low. The outcome of the half-year's working is an amount available for division of £14,498; and this will admit of the payment of dividends at the rates of 14, 11, and 9 per cent. per annum on the various classes of shares, and leave £99 to be carried forward. The Directors have decided to offer for sale, on an early date, £5000 of consolidated "B" stock.

The capital account shows that during the half year, the extension of buildings and plant has been proceeding—the amount spent under this head having been £3722. On distribution work £3251 has been expended; on additional new meters, £1234; and on stoves, £580. These items together make £8787, which causes the total expenditure on this account to be £3789 above the receipts, which amount to £340,820. As to the revenue account, the sale of gas in the half year produced £42,898; meter rental, £2092; residuals, £13,082; and rents £73—a total of £58,145, or about £6181 more than in the corresponding period of last year. But on the other side, the total expenditure is £43,319, or an increase of £3057. The larger sale of gas would mainly account for this; the manufacturing charges having run up from £29,294 to £32,886. In all the other items of outlay, differences occur. The balance carried to the net revenue account is £14,826; and in this statement may be seen, as already mentioned, a balance applicable to the half-year's dividends of £14,498. The reserve fund stands at £30,826; and the insurance fund at £14,456. The amount of coal used and sold in the half year was 30,301 tons; cannel, 539 tons; and oil, 24,408 tons. The quantity of gas made was 336,004,000 cubic feet; and the estimated production of residuals is given as: 370,080 cwt. of coke; 84,344 cwt. of breeze; 337,015 gallons of tar; 827,009 gallons of ammoniacal liquor; and 295 tons of sulphate of ammonia.

THE WINDING UP OF THE CHESTERFIELD WATER AND GAS COMPANY.

A Final Dividend Declared.

A Meeting of the Chesterfield Gas and Water Company was held last Tuesday on the subject of the winding up of the Company, whose undertaking, it will be remembered, was purchased a year ago by a Board composed of members of the Corporation of Chesterfield and representatives of neighbouring Local Authorities. The Chairman (Mr. R. T. Gratton) observed that, for the purposes of liquidation, they began their career on the 25th of March last, when the new Board paid the purchase-money. All preference shareholders then received their capital in full, and a surplus besides; while the holders of ordinary stock were paid £12 for each £10 share, with a promise of more at a future date. They had been enabled to arrange for a further dividend for the period between June, 1895, and March 25, 1896; and he had pleasure in stating that the preference shareholders would be paid a dividend of 5 per cent., and the ordinary shareholders 4 per cent. for that period, which was the extreme amount that could be paid under any circumstances. When they entered into liquidation, they had certain assets, which would, he believed, eventually enable them to pay the ordinary shareholders £1 for each £10 share. As regards the costs of the arbitration, they received £2029—a sum which was in excess of what they had anticipated. He proposed that the proceedings in the winding-up of the Company and the statement of accounts presented be approved. Mr. S. Burkitt seconded the motion; and it was carried unanimously. The Chairman then moved that a final dividend at the rate of 5 per cent. per annum, less income-tax, for the period between June 30, 1895, and March 25, 1896, be declared in respect of all guaranteed and preference stock and preference shares of the Company, and a final dividend at the rate of 4 per cent. per annum, less income-tax, for the like period, in respect of all ordinary stock and ordinary shares of the Company. Mr. Burkitt seconded the motion; and it was carried. Mr. Heane moved that £337 17s. 6d. be awarded to the Directors for their services for the nine months ending March 25, 1896; expressing the opinion that they were deserving of it. This was agreed to. The Auditors were also awarded £9 9s.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

The annual general meeting of the Barnsley Gas Company was held on Monday last week, under the presidency of Mr. E. G. Lancaster. The Secretary and Manager (Mr. W. W. Hutchinson) read the Directors' report, in which they recommended that, in addition to the interim dividend paid on the 1st of September last, a further dividend be paid of 6 per cent. on the general capital stock and "F" shares, 3 per cent. on the "C" (preference) shares, and 3½ per cent. on the "D," "E," and "G" shares, all less income-tax. The Directors expressed their pleasure in reporting that the allowance of 5 per cent. discount explained at the last annual meeting had worked most satisfactorily. In dealing with the accounts accompanying the report, the Manager pointed out that the cost of the manufacture of gas showed a decrease of £916; the distribution of gas, one of £67; and in other respects there was a reduced expenditure of £186—making a total decrease of £1169 on account of manufacture. The net income for gas was £888 less; the return from residual products, £39 less; and sundries, £10 less—making a total of £937. The Chairman, in moving the adoption of the report and accounts, remarked that, though the amount realized for gas sold, as explained by the Manager, was less, there had been an actual increase in the sale. They had pleasure in being able to produce figures which were so satisfactory as the present year's. At the last annual meeting, the Directors explained their proposals with regard to making allowances to their cash customers. He must confess that at the time they did so he had apprehensions; and it was with a considerable amount of anxiety that they awaited the outcome of the year's working. They were now glad to see that the result was eminently satisfactory, both to the consumers and the Company. Out of their 3000 consumers, they had only three who had not expressed themselves gratified with the first step made in regard to reductions. It provided the Directors constantly with a balance of £2000 or £3000 more at the bank, and had considerably reduced the bank charges. The system had worked well, and left them with a small balance. He thought it would hardly be fair to hold out hopes that in the immediate future they would be able to do much more in the way of reducing the price; but this did not alter their policy, which was at the very earliest opportunity to increase the discounts from 5 to 10 per cent. The report was adopted; and a vote of thanks was accorded to the Chairman, Directors, and Manager for their excellent services.

At the half-yearly general meeting of the Bath Gas Company next Friday, the accounts to be presented by the Directors will exhibit the satisfactory feature of a decrease in expenditure and an increase in income during the six months ending Dec. 31. The gas sold to private consumers produced a revenue of £24,842; that for public lighting, £2544; the rental of meters, stoves, and fittings, £1348; residuals, £4729; and the total receipts were £33,670. The manufacture of gas cost £20,449; its distribution, £2419; management, £1469; and the total expenditure was £26,135—leaving £7535 to go to the profit and loss account. The amount available for distribution is £10,453; and the Directors will recommend the declaration of the maximum dividends. In their report, they remark that the gas-rental is most satisfactory, and is due, to some extent, to the large number of prepayment meters fixed, and the gas-stoves in use in connection with them.

The Carmarthen Gas Company had a very respectable increase in the sale of gas last year—the quantity sold having been 16,842,000 cubic feet, as against 15,959,000 feet in 1895, or an additional 883,000 feet. The amount of coal carbonized was 1797 tons, against 1943 tons in 1895. On March 31 last, the price was reduced to 4s. 3d. per 1000 cubic feet for lighting purposes; and the Directors are able to announce that there will be a further reduction of 1d. from March 31 next—making the price 4s. 2d. for lighting, and 3s. 8d. for cooking and other purposes. The profit on the working for the year is £1347; and from the balance remaining after paying £162 on the mortgage stock, 7½ per cent. on the ordinary shares and 7 per cent. on the new shares has been declared.

The annual general meeting of the Derby Gas Company was held last Thursday—Mr. H. Swingler, J.P., the Chairman of the Company, presiding. In moving the adoption of the Directors' report, he referred to the recent sale of the Company's stock, and said that when they next went to Parliament they would ask to consolidate their stock in the same way that other gas companies had done, the result of which would be that there would be a reasonable dividend, and not what appeared to be an exorbitant one nowadays. With regard to further expenditure, they had under consideration the adoption of water-gas plant similar to that in use at Birmingham; and they had estimates at the present time for the work. He could not say what it would amount to; but he quite expected that it would involve an expenditure of from £10,000 to £20,000. Turning to the accounts, he said their expenditure had not been at a very fast rate—amounting to £9718 during the year; £6000, or roundly speaking £7000, being for various extensions and improvements at the works, £587 for new mains, £2000 for new meters, and £200 for new stoves. With regard to the revenue, there was a satisfactory rise in the quantity of gas sold, of 13,380,000 cubic feet; and the total sale in the year was 406 millions. He was glad to see that the sales of cooking-ranges and gas-fires were still going on increasing; and at the present moment they had nearly 1000 in use in various parts of the town. The only portion of the accounts one had to regret was that referring to the residuals; and in this they were as good as helpless. Mr. W. M. Richardson seconded the motion; and it was unanimously carried. The usual dividends of 10, 7, and 5 per cent. on the stocks respectively entitled thereto were then declared.

The balance-sheet of the Eckington and Mosbro' Gas Company shows that there is £1717 standing to the credit of the profit and loss account, including the balance of £830 brought forward from the previous year's account. The Directors recommend dividends of 9 and 7 per cent. on the original and additional shares respectively, which will absorb £820. The gross income was £2207, as against £2001 in the preceding year.

The revenue from the sale of gas by the Heckmondwike Gas Company in the half year ending Dec. 30 was £5874; residuals produced £1069; and the total receipts were £7232. The expenditure amounted to £4999; leaving £2233 to go to the profit and loss account. The balance applicable for distribution was £3739; and the Directors have declared interim dividends of 4s. each on the "A" shares, 1s. 6d. each on the "B" shares, and 3s. each on the "C" and "D" shares. Under the management of Mr. A. F. Goodson, 4967 tons of coal and cannel were carbonized; and 46,939,900 cubic feet of gas were sold—1,305,500 cubic feet being for the public lighting of Liversedge. The estimated quantities of residuals were: Coke, 2980 tons; tar, 335 tons; ammoniacal liquor, 601 tons.

At the annual meeting of the Ipswich Gas Company, held on Monday last week, under the presidency of Mr. G. Biddell, the Directors reported a balance of £13,707 (including £4051 brought forward) to the credit of the profit and loss account. Of this amount, £4714 had been applied in payment of an interim dividend at the rate of 12 per cent. per annum on the "A" stock, 9½ per cent. on the "B" stock, and 9 per cent. on the "C" stock for the half year ending June 30. The Directors recommended a further dividend at the same rates, after payment of which a balance of £4279 would remain. The Directors stated that there has again been a satisfactory increase in the receipts from the sale of gas; but, as was anticipated, a decrease in the receipts for residual products. The whole of the streets in the borough are now lit by incandescent gas-burners, which appear to give general satisfaction. The contract for the new holder, to contain about a million cubic feet of gas, has been let to Messrs. S. Cutler and Sons, of Millwall; and it is expected that the holder will be ready for use in the early part of next winter. The Directors have, after mature consideration, started sick and superannuation funds for the benefit of the whole of the Company's employees. The men contribute to these funds weekly a portion of their pay; and the Company add not less than a corresponding amount. The employees will by these means be assured against want in their old age. The Chairman, in moving the adoption of the report, gave some interesting particulars to show the effect of climatic changes upon the Company's business—contrasting 1896 with 1895. He said that the mean average daily temperature of the first three months of the year was 39°. Last year it was 42°—being 3° above the average; and for the corresponding months of 1895 it was 34°, being 5° below it. The difference between 1895 and 1896 was therefore 8° for the three corresponding months. This for 90 days gave a fair measure of the discomfort of a severe and protracted winter, contrasted with a warm and genial one such as that of 1896. The average daily temperature for the first six weeks of the present year had been 36°, or 2° below the average. These figures as to temperature had a great influence upon the returns from the gas industry, though the many purposes other than that of lighting for which gas was being used was rendering suppliers more independent of variable seasons. At this time last year, they were dropping behind in the consumption of gas and the sale of coke, so mild was the season; but now, he was glad to say, they had not only paid their maximum dividends, but had carried forward a balance of £4279—an increase of £228 on 1895—and this notwithstanding the continuous low prices for coke and sulphate of ammonia, which together showed a loss of £928, as compared with the receipts for 1895. Their actual sale of gas for the past year—a warm one—had been 223½ million cubic feet, or an increase of 2½ per cent. on 1895; the actual receipts being £1128 more for gas, meters, &c. For the additional gas consumption they were greatly indebted to the extended use of slot meters, of which 2500 were now fixed, or 650 more than at the end of 1895, while 150 were still on order. These meters had yielded one-seventh of the total receipts for gas—namely, £4606—a sum made up of about 1,100,000 pennies, weighing 9 tons 15 cwt. Much of the general increase was also due to the use of gas for cooking, heating, and motive power purposes. Dealing with the accounts, he said the capital represented, per ton of coal carbonized, the low figure of £5 9s. 5d., as compared with £5 12s. 7d. in 1895. The new retort-settings continued to show a satisfactory saving in coke, equal to fully 1 cwt. per ton of coal carbonized. The total expenditure on revenue account was £32,425, or £153 less than in 1895; the cost of gas manufacture was £24,506, or £537 less; and the distribution expenses were £3213, or £686 more, of which £167 (in some years it had been more than £200) was paid to the town authorities for making good roads and paths after the Company's servants had rammed up the pipe-trenches. The receipts for residuals were £9961, or £831 less than last year—coke and sulphate having both been lower in price than in 1895. There was an increasing demand for coke, for domestic as well as other purposes. The leakage had been reduced from 5·79 to 5·23 per cent.—a result which the Directors considered to be most gratifying. The greatest output of gas in one day was 1,321,000 cubic feet, in December last, which beat the former record. In the month of January, 1895, they sent out 31¼ million feet; in January, 1896, 29½ millions; and in the same month of the present year, 33¼ millions, or 2 millions more than in 1895. So they were starting exceedingly well towards a good yearly output, in what might be called a typical season, intermediate between the winters of 1895 and 1896. There were about 3000 ordinary meters on hire, and 933 cooking-stoves; and gas-engines numbered about 80, some of which were used for electric lighting. This was the cheapest way of producing the current by any engine power. But even then, light for light, and fairly measured, electric lighting was three times more costly than gas at 2s. 10d. per 1000 feet, when consumed by the incandescent burners. Gas never had a better prospect, nor a more certain good future, than at the present time. All they had to do was to study and adopt the best methods of cheapening its production, to take care to keep up the facilities for meeting the increased demand, and at the earliest opportunity to reduce the price. In conclusion, the Chairman referred with great satisfaction to the establishment of the sick and superannuation fund in connection with the Company, which had met with the heartiest approval of all their staff and workmen, and which would, he felt assured, give equal satisfaction to all the shareholders. The Vice-Chairman (Mr. D. Ford Goddard, M.P.), in seconding the motion, paid a well-deserved tribute to the interest taken in the Company by the Chairman, and to the valuable information contained in the speech he had just delivered. With regard to electric lighting, he (Mr. Goddard) had no fear of it as a direct competitor with gas. They knew from experience that the more light people had, the greater demand there was for it. Touching upon the establishment of the sick and superannuation fund, he expressed a belief that the shareholders would enjoy their dividends all the better from having the knowledge that their employees would be well cared for when sick or too old for work. In conclusion, he paid a high compli-

ment to the Secretary and Manager (Mr. J. T. Jolliffe) for his skill and watchfulness in keeping the works thoroughly up to date. The motion was carried unanimously; and the dividends recommended were declared. The Directors were authorized to raise £20,000 by the creation and issue of new ordinary stock under the powers of the Company's Act of 1883, and to borrow a proportionate amount. A vote of thanks was passed to Mr. Jolliffe and the staff, and also to the Chairman.

The eleventh ordinary general meeting of the Matlock and District Gas Company is to be held to-morrow, when the Directors will report a net profit for the past year of £1922. Adding to this the unappropriated balance brought forward, £208, a sum of £2130 is produced. Against this, there is the interim dividend paid in August, amounting to £962, and the debenture interest, £182; thus leaving for disposal £986. The Directors will recommend that this shall be applied as follows: In paying the statutory dividend at the rate of 5 and 3½ per cent. on the respective classes of stock, which will absorb £931; and carrying forward the balance of £55. The whole of the Company's expenses in connection with their opposition to the Bill of the Matlock Bath Urban District Council, amounting to £461 11s. 4d., have been paid. The total share capital of the Company is £24,250, of which £19,700 is ordinary stock, and the rest debentures. On the first class, powers remain to call up £6500; and on the second class, £2000 is still to be issued.

The annual general meeting of the Newmarket Gas Company was held on Monday last week—Mr. R. Stephenson in the chair. The Manager and Secretary (Mr. J. H. Troughton) read the Directors' report, which showed a net profit balance of £3501, and a total of £4938 standing to the credit of the profit and loss account. The Directors recommended the payment of a dividend at the rate of 6½ per cent., less income-tax, upon the original consolidated stock, which would absorb £3625, and leave £1313 to be carried forward. The Chairman, in moving the adoption of the report, remarked that the profits were not quite so large as last year, but that the dividend was the same. He pointed out that the Company had lost £800 by the reduction in the price of gas in July, 1895; the consumption not having increased sufficiently to recoup the Company for this loss. The report having been adopted, Mr. Rodrigo put some questions as to the registration and testing of meters, which were answered by the Manager and Secretary. He specially emphasized the fact that there could be no registration without gas consumption. Mr. Rodrigo remarked that some people did not know this. He then asked if there was likely to be a reduction in price during the present year. The Chairman replied that there had not been sufficient increase in the consumption to warrant the Directors in doing so. Mr. Rodrigo said he was sure they would do better if they sold gas cheaper, as people would not be so economical in using it. The Chairman said further reductions would depend entirely upon the consumers. If the consumption increased, the price would be lowered as a matter of course. The Manager and Secretary pointed out that the Company had to earn an additional £800 per annum to make up the reduction of 2d. per 1000 cubic feet. In the course of further conversation, Mr. Rodrigo mentioned the fact that he had had one mantle in use on an incandescent burner for more than twelve months. One of the Directors added that he had two incandescent burners in use for upwards of twelve months; and other gentlemen spoke of the length of time mantles would last if treated with ordinary care.

The half-yearly meeting of the Peterborough Gas Company was held last Tuesday—Mr. W. Harris presiding. The Directors in their report stated that the balance of the profit and loss account (including £164 remaining from the previous half-year's account) was £3351. Out of this sum, after providing for payment of the preferential dividend on the 5 per cent. new "A" preference shares, the Directors recommended the maximum dividends on the remaining share capital of the Company, less income-tax. The payment of these would absorb £2656, and leave a balance of £694, out of which the Directors advised that £200 be placed to the credit of the contingent fund, and that the balance remain at the credit of the profit and loss account. In moving the adoption of the report, the Chairman, after referring to the increased consumption of gas, said the purifying plant would have to be enlarged, and a larger number of retorts would be required. Expenditure on other parts of the works would also be necessary. A question was asked as to whether the Company intended taking up electric lighting. The Chairman replied that all the capital they had to call up would be required for their own purposes. Moreover, they could not do anything with the electric light except by the formation of another company with fresh capital. The report having been adopted, dividends at the rates of 5, 10, and 7 per cent. per annum were declared.

The result of the half-year's working of the Pontefract Gas Company is a divisible sum of £1311, out of which dividends of 10 and 7 per cent. are to be paid.

At the half-yearly general meeting of the Reading Gas Company to-day, the Directors will report with satisfaction the continued growth of the business, as proved by the increased consumption of gas in the six months ending Dec. 31, as compared with the corresponding period of the preceding year. The sale of gas produced £22,683; residuals, £5681; and the total revenue was £28,426. The expenditure being £23,177, there was a balance of £5249 carried to the profit and loss account. The amount available for distribution is £17,002; and full dividends will be recommended on all the stocks and shares. Under the supervision of Mr. Edward Baker, Assoc.M.Inst.C.E., the Company's Engineer, 15,440 tons 13 cwt. of mixed coal were used in the six months covered by the report; and the sales of gas were 152,368,100 cubic feet for private and 10,252,141 cubic feet for public lighting and under contracts. The residuals were: Coke, 15,440 chaldrons; breeze, 132 chaldrons; tar, 157,571 gallons. There were 170 tons of sulphate of ammonia made, the whole of which was sold.

At the forthcoming half-yearly meeting of the Riddings District Gas Company, the Directors will present the accounts for the six months ending Dec. 30. They show that in this period £1655 was received from gas supplied for public and private lighting, and that the total revenue amounted to £1880. The expenditure was £1129; so that the balance carried to the profit and loss account was £751. The amount standing to the credit of this account is £1463; and the Directors will recommend a dividend for the past half year at the rate of 5 per cent. per annum, less income-tax.

The operations of the Rochester, Chatham, and Strood Gas Company last half year were of a progressive nature; and the balance at the credit of the revenue account was sufficient for the declaration at the recent meeting of the full statutory dividends of 10 and 7 per cent. The demand for gas continues to steadily increase, and no difficulty has been experienced during the past winter in affording an adequate supply to the consumers. The accounts show a total revenue for the six months of £29,407, of which nearly £22,040 was from sales of gas. The total expenditure amounted to £26,370; so that there was realized a profit of about £3037.

The report of the Directors of the Scarborough Gas Company which was noticed last week has been submitted to the shareholders, at their ordinary meeting, by the Chairman (Mr. B. Fowler). In the course of his remarks, he made the satisfactory announcement that, in the past half year, the sale of gas was 7 million cubic feet more than in the corresponding period of 1895. The receipts for the six months amounted to £23,229—an increase of £966; and this would have been much greater but for the low prices of residuals. The Directors, he also mentioned, had decided to reduce, from April 1, the price of gas by 2d. per 1000 feet; and to allow, instead of 3d. discount for prompt payment, 7½ per cent. of the bill. This, he calculated, would really mean that the price charged for gas would be brought down to 2s. 7d. per 1000 cubic feet net.

At the annual meeting of the South Shields Gas Company next Friday, the accounts to be presented by the Directors will show that the revenue for the past year was £62,295, and the expenditure £44,335; leaving a balance of £17,960. After adding the balance of £358 brought from the last account, and deducting the interim dividend and interest paid during the year, amounting in all to £9479, the net revenue account has an available balance of £8839. A dividend of 4¾ per cent. for the six months ended Dec. 31 will be proposed; making, with the interim dividend of 4½ per cent. paid in September, 9¼ per cent. for the year. This will absorb £7871, and leave a balance of £968 to be carried forward. In their report, the Directors remark that the revenue was adversely affected to the extent of £1699, as compared with the previous year, by reason of the lower prices received for residuals, especially for sulphate of ammonia, which still stands at a very low figure. The sale of gas for the year was 415,661,851 cubic feet; and the net rental amounted to £46,622. There was, at the same time, an increase of 506 consumers. The extended demand for gas, not only for lighting but for cooking, heating, and motive power, will, in course of time, necessitate further capital expenditure; and a resolution will therefore be submitted to the proprietors to authorize the sale of £10,000 of new stock, and the issue of £5000 of mortgage bonds, as required. Under the supervision of the Company's Engineer and Manager, Mr. W. J. Warner, 46,846 tons of coal and 1119 tons 13 cwt. of cannel were carbonized last year; the estimated quantities of residual products being: Coke, 29,682 tons 15 cwt.; tar, 481,385½ gallons; ammoniacal liquor, 479,530 gallons, which was manufactured into sulphate of ammonia.

The Thorne Gaslight Company is only a small concern; but on last year's working, the Directors are able to pay a dividend of 10 per cent. and a bonus of 2½ per cent., and to carry a substantial balance forward. The price of gas is 4s. 2d. per 1000 cubic feet.

Unusual interest will attach to the half-yearly general meeting of the Weymouth Consumers' Gas Company next Thursday, in view of the hostility shown by the Corporation to the Bill of the Company now in Parliament. In their report, the Directors state that, in order to meet the increasing business of the Company, it will be necessary to provide additional manufacturing and distributing plant; and the recent extension of the borough having brought within the town limits certain roads which the Town Council require to be lighted, the necessity has been placed upon the Company of laying about two miles of mains for the purpose. To cover the cost of these extensions, and to provide for future requirements, the Directors have called up the amount unpaid on the ordinary shares, and have deemed it desirable to apply for power to raise further capital. They report a substantial expansion of business during the past half year; the sale of gas showing an increase of 5¾ per cent. upon the corresponding half of 1895. Residuals, owing to the low prices prevailing for coke and sulphate of ammonia, have not been so profitable as before. The items of expenditure, except that for coal, which shows an increase both in the quantity used and in the cost, are of the average amount. The profit made was £2497, out of which the interest on the debenture bonds has been paid. The Directors recommend a dividend for the half year at the rate of 10 per cent. per annum on the "A" stock, and 7 per cent. per annum on the ordinary shares (less income-tax)—the balance to be carried forward.

The Directors of the Wolverhampton Gas Company, in their half-yearly report, state that there has been a net profit of £9362, which, added to the balance of last account, makes a total of £10,245. Out of this they recommend the payment of dividends of 3 per cent. upon the preference stock, 5¼ per cent. upon the consolidated stock, and 3½ per cent. upon the new ordinary stock, less income-tax. This will leave a balance of £2836, out of which the Directors advise that £646 should be placed to the reserve fund account; making with the sum to be paid in respect of dividends on the consolidated and new stocks of the Company a total equal to the statutory dividends permitted to the Company at their present price of gas. They further recommend the placing of £1000 to an insurance fund. The general improvement of trade has so greatly increased the consumption of gas that, to meet the still growing demand, it will be necessary during the coming summer to further increase the manufacturing plant at the Stafford Road works.

The shareholders of the Yeadon Gas Company were last Wednesday congratulated by their Chairman (Alderman T. Denison) on the continued prosperity of the concern. Notwithstanding the fact that nearly all the mills in the district had been working during daylight only, the sales amounted to almost the same as in the corresponding half of 1895, which was the largest the Company ever had. This state of things was brought about by the increased consumption by householders and shopkeepers, who were using gas-stoves and gas-fires. Prepayment meters were now being fixed in greater numbers, and were giving satisfaction. During the six months, 3946 tons of coal, costing 10s. 10d. per ton, were used, as compared with 3958 tons at 11s. 1d. per ton in the second half of 1895. The quantity of gas sold was 30,234,000 cubic feet; this quantity being 77,000 cubic feet less than twelve months ago. The report was adopted, and the maximum dividends were declared.

Water Companies.

The revenue of the Brompton, Chatham, Gillingham, &c., Water Company for the past half year amounted to £8770; and the profit to £3468. A dividend of 10 per cent. per annum has been declared.

The annual meeting of the Liskeard Water Company was held last Thursday, when the accounts for the past year were presented. The revenue account showed receipts from rents, £875; interest on deposit, £5; and the balance brought forward made a total of £1279. Interim dividends had been paid; and there was a disposable balance of £416. Out of this it was decided to pay a further dividend at the rate of 9½ per cent. per annum; and to carry £50 to the reserve fund, and £86 (the balance) to the credit of next year's account. The capital called up is £5100. The undertaking has been a financial success for the shareholders, in addition to conferring a great boon on the inhabitants. The construction account stands at £8224; and the purchase of land and buildings absorbed £99. This is regarded as one of the cheapest and most successful water-works constructed in the West of England. The cost of maintenance was £280 only for last year.

A substantial increase of revenue is disclosed by the report of the Directors of the Newcastle and Gateshead Water Company for the past year. The additional sum is £6264; and £39,018 is available for distribution. The dividends now recommended will make, with the interim payments, 7½ per cent. for the year on the ordinary stock, and 5½ per cent. on the 1876 stock. The amount to be carried forward is £1007.

The report of the Directors of the South Hants Water Company, noticed in the "JOURNAL" last week, was presented to the shareholders at their annual meeting on the 12th inst. The Chairman (Mr. W. E. Darwin), in moving its adoption, remarked that it showed that the Company were doing as well as he hoped they ought to do. Referring to the fact that the dividend had been made up to 7½ per cent. on the ordinary, and 5¾ per cent. on the new ordinary shares, he said he wished it to be understood that this did not imply that they had made an extraordinary jump forward during last year, because if it had not been for causes which cost them £875 the previous year, they would then have been in a position to pay the extra 1 per cent.; so that the increase at the present time was only a normal one, coupled with that of last year. Referring to the transfer of £411 to the depreciation account, he said that when they went before the Parliamentary Committee, it would be considered greatly in their favour that they had been forethoughtful enough to put by a depreciation account to prepare for eventualities. The net increase in the rental last year amounted to £1360, as compared with £1291 in the previous twelve months. Referring to the Bill promoted by the Southampton Corporation to acquire the Company's undertaking, he said the Directors had determined, after great consideration, to fight out the matter to the uttermost. They felt they were bound to do so in the interest of the proprietors; and they thought they had a very good case indeed. There had been a meeting of ratepayers, and a remarkable feature of the report of the proceedings was the absence of figures to guide the burgesses on the subject of the purchase of the works. It struck him as being a series of very interesting speeches on the charms and advantages of municipalization, and the absorbing of various undertakings, all of which were very interesting and instructive. If by "municipalization" they meant the buying up of any undertaking one wished at a dirt-cheap price, it was very pleasant for the ratepayers, and might redound to the honour and glory of the Corporation. But he had not seen any figures which would cause him to change his mind; and the ratepayers' meeting would not affect the determination of the Company to fight out the matter. The Directors would go into the forthcoming struggle with perfect confidence in the justice of their case; and the interest of the shareholders would be protected in every way. He did not think the existence of the Company was going to be terminated by the Corporation or anyone else. The report was adopted.

The report of the Directors of the Sunderland and South Shields Water Company, which will be presented at the meeting of shareholders to-morrow, states that the revenue in the past year showed a net increase of £1076, after deducting the additional working expenses. There is a balance of £47,476 on the profit and loss account; and the Directors will recommend a dividend at the rate of 4½ per cent. on the ordinary and preference stocks, for the half year ending Dec. 31, free of income-tax—making with the interim dividend paid in September 9 per cent. for the year; also the payment of interest at the rate of 5 per cent. per annum on the amount called up on the allotted shares. With the object of making still further provision to meet the increasing demands on the available supply of water, the Directors have acquired a site at West Burdon for a third additional pumping-station. Boring operations have been for some time in progress; and the permanent works are to be immediately commenced. Having nearly exhausted their borrowing powers under the Company's Act of 1868, the Directors intend to ask the proprietors for authority to create £100,000 of new 5 per cent. capital, sanctioned by the Act of 1891, and to offer it by public auction.

Walsall Gas and Electricity Supply.—At the last meeting of the Walsall Town Council, the Gas Committee reported that during the past year a profit of £7538 had been realized on the working of the Gas Department—an increase of £400 on the previous year. The price of the gas had also been reduced from 2s. 8d. to what was practically 2s. 4½d. per 1000 cubic feet. The gas was as cheap and as good as it was in any town in the Midlands. The introduction of electricity had displaced about 2¼ per cent. of the gas. A sum of £5000 had already been voted to the borough fund; and the Committee proposed to add another £500 to it. They would allocate from this £500 towards the expense of providing the manual stoking machinery. The remaining £1538 would be added to the reserve fund; bringing it up to £12,157. The Committee recommended that the price of each public lamp in future should be £2 5s. instead of £2 7s. 6d., the effect of which reduction would be to relieve the general district rate to the extent of about £150 per annum. The Electric Lighting Committee reported that there had been on the first year's working of the Electricity Department a loss of £445. This result the Committee considered was very satisfactory, having regard to the fact that at the commencement of the year the number of consumers was much less than at the present time; and they had every reason to hope that the demand for current would increase for both lighting and motive power.

EDINBURGH AND LEITH GAS COMMISSION.

The Appointment of an Engineer.

As briefly notified in the "JOURNAL" last Tuesday, a Special Meeting of the Edinburgh and Leith Gas Commission was held on Monday, the 15th inst., "to appoint an Engineer, in terms of resolution come to by the Commissioners" on the previous Friday. Lord Provost M'DONALD presided.

There was before the meeting a minute of a meeting of the Commissioners on the 12th inst., containing a report by the Special Committee who were appointed on the 21st of December last to (*inter alia*) advertise for a Chief Engineer, and report upon the applications received. The report was in the following terms:—

An adjusted advertisement for an Engineer having been inserted in various newspapers, about 70 inquiries were received. Thereupon a schedule of queries was prepared, and prints were sent out to all inquirers. At a meeting held on the 18th ult., the 41 applications received were gone over carefully, and 20 were selected as deserving of further consideration. At a subsequent meeting, on the 27th ult., these 20 applications were again before the Committee, when five were selected as being the most suitable. The Committee asked Bailies Kinloch Anderson and Manclark, Councillor Waterston, and Mr. Walcot, to visit the five applicants, and to report what they thought of them. Visits having accordingly been paid, and the Sub-Committee having reported that they considered that Messrs. John Ferguson Bell, Engineer and Manager of the Stafford Corporation Gas-Works, W. Ralph Herring, Engineer and Manager of the Huddersfield Corporation Gas-Works, and Alex. Wilson, Manager of the Dawsholm, Temple, and Kilpatrick Gas-Works of the Glasgow Corporation, were the most suitable, the Committee resolved to submit the names of these three applicants to the Commissioners, that they might select as their Chief Engineer whichever they considered best. Messrs. Bell, Herring, and Wilson have arranged to meet the Commissioners as desired, on Friday, the 12th inst.

Messrs. Bell, Herring, and Wilson were called in separately, and answered the questions put to them. They having retired, the Commissioners, before voting, as after mentioned, unanimously resolved that they would, on Monday next, unanimously support the candidature of the applicant who might secure the most votes at the final division at to-day's meeting. The first vote resulted as follows: For Mr. Bell, 3; for Mr. Herring, 7; for Mr. Wilson, 8. Mr. Bell having the least number of votes, the Commissioners proceeded to their second division, which resulted as follows: For Mr. Herring, 9; for Mr. Wilson, 9. There being an equality of votes, the Chairman gave his casting vote in favour of Mr. Herring. Councillor Dickson declined to vote in either of the divisions.

The LORD PROVOST said their business was to look at Friday's minute; and he moved approval of it.

Bailie KINLOCH ANDERSON seconded the motion.

Mr. DICKSON said he begged to move an amendment, because the meeting on Friday was not called for the purpose of what was done at it. The meeting was said to be to hear the Committee's report; but they went farther, and voted on the three candidates, which he did not approve, and when he found that he dissented.

The LORD PROVOST: You did not dissent. Nobody said a single word until after the business was over. You did not give us your opinion.

Mr. DICKSON: Well, that was part of my opinion, because I thought the members who were not here had been taken in. If you had said that the members were summoned to vote on the candidates, I believe they would all have been here; and I think everyone should have another opportunity of voting.

Judge COLSTON rose to a point of order. This gentleman had, he said, his opportunity of voting before, and did not avail himself of it. It was quite well known that there was to be a vote on the question; and their friend did not vote. If he had done so, he might have cast the scale the other way. But he did not; and it would not do to come there and say these things.

The LORD PROVOST: Oh, no. I think what we have to do now is to say whether this minute is correct.

Mr. DICKSON: I want to know if I could move an amendment to have the vote taken over again.

The LORD PROVOST: Certainly not.

Mr. DICKSON: Then what was the use of summoning us here to-day to do the thing over again?

The LORD PROVOST: I think, to make our position perfectly clear. You knew quite well what we were summoned here for on Friday. It was to see the three candidates, to ask them any questions, and to find the opinion of the Commission as to the man to be selected, and if possible to make it unanimous. You were unanimous that you would go forward upon that condition.

Mr. DICKSON: I never opened my mouth.

The LORD PROVOST: Well, if you did not open your mouth, I must hold you to have been consenting. We cannot tell what is in people's brains if they do not open their mouths. Mr. Waterston said that, if we went to a vote without speeches, he would be perfectly willing to abide by the decision.

Mr. WATERSTON denied that this was the meaning of the words he used. He said the Lord Provost was putting quite a different construction upon them.

The LORD PROVOST said Mr. Waterston stated that he would be loyal to whichever man had a majority of votes, and that he would come up on Monday with a unanimous finding that he would be the man. It was about as honest a bit of public business as he (the Lord Provost) had ever seen; and they were there that day to confirm it, he hoped, and to name the salary to be given. That was all their business.

Mr. WATERSTON: I was told that I should not raise certain questions; and I said that if the merits of the candidates were not to be gone into, and if I were not to take up the position of making an attack upon one of the candidates whom I thought had erred, I would accept a majority, and would loyally accept that. But immediately on its being known, I rose——

The LORD PROVOST: No. I rose when the business was finished.

Mr. WATERSTON: I immediately rose, and said I objected to you giving a casting vote when others were not present.

The LORD PROVOST: No; it was given before you spoke. The voting was calmly gone about, and then you objected.

Mr. HUNTER (to Mr. Waterston): The Lord Provost certainly said "Mr. Herring" before you rose.

Mr. WATERSTON: I did not hear it.

Mr. EUNSON said he remembered that Mr. Waterston rose and remarked: "As the vote is equal, would you not give your casting vote?" He (Mr. Eunson) did not know the vote had then been given—it must have been very smartly done.

The LORD PROVOST: But it was given. Supposing I had given my casting vote for the other man, would we have been here to-day discussing this?

Judge COLSTON stated, on a point of order, that the minutes were only up at that meeting as a true record of what took place, according to their Standing Orders. He wished also to say that Mr. Dickson was entirely precluded from moving an amendment, because he was present and did not dissent.

Mr. J. G. HOLBURN, M.P., said he was one of the members who were not present on Friday; but he was not going to dissent from what they did. The man they had selected was not the man he should have; but he had given full consideration to the minutes, and was satisfied that the Committee came to a wise decision.

The minute of Friday's meeting was then approved.

Baillie KINLOCH ANDERSON said he rose to heartily congratulate the Committee on the selection they had made. He believed it was a most judicious one, and one which would be greatly in the interests of gas consumers. They had an excellent lot of candidates; and any one on the short leet would have been a credit to Edinburgh. The majority had preferred Mr. Herring; and he was perfectly satisfied that they would never regret his election. He moved that his salary be fixed at £900, and that his whole time be devoted to the service of the Commission.

Mr. HUNTER seconded the motion.

Mr. EUNSON moved, as an amendment, that the salary be £800; remarking there was no justification for their giving away £100 a year more than they could get a good man for.

Mr. WATERSTON seconded the amendment.

On a division, the motion was carried by 12 votes to 6.

Mr. MACKIE, in moving a vote of thanks to the Special Committee, said he thought it was only fair to certain gentlemen in Scotland to say that their names would undoubtedly have been placed on the short leet but for the question of their age.

The LORD PROVOST said this was quite true. They had found that there were a great many very able gas engineers in the country; and the closeness of the vote showed the difficulty they had had in making a selection. He thought that the man they had appointed would do credit to Edinburgh, and that the complaints they had been having would be stopped when he got a grip of his work.

It was remitted to the Special Committee to arrange for Mr. Herring entering upon his duties.

METROPOLIS WATER SUPPLY.

The Proposed Amalgamation of the London Water Companies.

As briefly notified in the "JOURNAL" last week, the Bill brought in by Sir F. Dixon-Hartland, Mr. Bigwood, Mr. Howard, and Mr. Stephens, for effecting the amalgamation of the London Water Companies, has been issued. It is prefaced by a "Memorandum," which sets forth that the Bill proposes to "control, amalgamate, and appoint districts somewhat on the lines of the Gas Act of 1860, before which there was much complaint which has now practically ceased. The ratepayers by these means will be benefited without any burden on the rates, as, for example, (1) by ensuring against the possibility of any future water famine; (2) by reducing and equalizing the water charges, and giving the surplus, beyond a now fixed income on the Companies' outlay, in reduction of the charges on consumers, and (3) by removing the rival interests of the inner and outer circles." The following are the principal portions of the Bill:—

The preamble states that it is expedient to amalgamate the Water Companies in and around London; and clause 1 gives the short title of the proposed Act to effect this object as the "London Water Amalgamation Act, 1897."

Clause 2 specifies that, for the purpose of determining the matters by the Act referred to arbitration, an ex-Lord Chancellor, Law Lord, or member of the Judicial Committee of the Privy Council shall be appointed by the Board of Trade as sole Arbitrator, whose decision is in all matters to be final, and without appeal, unless he shall on any point in his absolute discretion desire a decision of the High Court, in which case such decision is to be obtained in the Court of Appeal.

The next clause defines the expression "the Water Companies" to mean the eight Metropolitan Water Companies—*i.e.*, the Chelsea, East London, Grand Junction, New River, West Middlesex, Kent, Lambeth, and Southwark and Vauxhall Companies. "The southern Companies" means the Kent, Lambeth, and Southwark and Vauxhall Companies; "the western Companies," the Chelsea, Grand Junction, and West Middlesex Companies; and "the northern Companies," the Chelsea, Grand Junction, West Middlesex, and East London Companies, with or without the New River Company, as the Companies may agree or as the Arbitrator to be appointed under the Act may direct.

By clause 4, the Companies are to submit within six months from the passing of the Act, or such further time as the Arbitrator may allow, schemes for effecting such amalgamations as may be enacted. Provision is made that the northern Companies may submit a joint scheme to effect the objects of the Act, so far as it affects them; and the southern Companies may do likewise. Any one or more of the former, or any one or two of the latter Companies are to have power to submit a separate scheme.

Clause 5 specifies that within two months after the deposit of the schemes above referred to, the City of London and any County Council having jurisdiction within any portion of the district of supply of the Companies, any District Council within the district, and shareholders in any of the Companies, may lodge objections to the schemes; and the City or any of the Councils shall be entitled to appear and be heard, and such District Councils and shareholders as the Arbitrator may, in his discretion, direct may be permitted to appear, in support of their objections to the schemes.

The next clause sets forth that within one year after the passing of the Act, the Chelsea, Grand Junction, and West Middlesex Companies shall be amalgamated into one Company; and the Kent, Lambeth, and Southwark and Vauxhall into another. The East London and New River Companies are to be amalgamated; or, in the discretion of the Arbitrator, the latter may remain a separate undertaking, in which case the former Company will amalgamate with the western Companies. If they so agree, all the northern Companies may be amalgamated. If the Arbitrator so directs, all the new Companies shall, within five years, be amalgamated into one Company, and the stocks consolidated. All the terms and conditions of the amalgamation are, except as specially provided, to be in the discretion of the Arbitrator, who, in any event, is to provide that within one year provision shall be made for the due supply of water by each Company to the other in time of scarcity, and for their having their water supply interchangeable.

Clause 7 makes provision for the creation of stock. There is to be created, under the authority of the Act, so much stock as shall be declared by the Arbitrator to be necessary for the purposes thereof. This stock is to be divided into several classes. In the case of the southern Companies, it is to be termed South Metropolitan water stock. It will be divided into "A" stock, in exchange for the debentures, debenture stock, and preference shares or stock of the southern Companies; and "B" stock, in exchange for the ordinary stock. In the case of the northern Companies, the stock is to be termed West Metropolitan and East Metropolitan or New River water stock. It is to be divided into "A" stock, in exchange for the debentures, debenture stock, and preference shares or stock of the northern Companies, and in case of the New River Company, in addition, in place of King's and Adventurers' shares; and into "B" stock, in exchange for the ordinary stock. The next clause specifies that all the "A" stocks are to be trustee stocks. The amount of each stock to be issued to each of the Companies is to be decided by the Arbitrator after hearing the Companies and opponents as to all circumstances which he in his absolute discretion may deem admissible as affecting the value of the property of the Companies. All real estate not connected with their undertaking is to remain, unless otherwise directed by the Arbitrator, the property of the Companies.

Clause 9 deals with the formation of the Boards of the new Companies and the compensation of officers. The Boards are to consist of three Directors from each of the component Companies, and elected by them, with the addition of two Directors to be appointed by the Board of Trade, who are to be the same persons in the case of all the new Companies. All Directors and officers of the old Companies superseded by the operation of the Act are to receive such compensation as the Arbitrator may direct; and he is to hear the parties concerned before fixing the amount of their compensation, which may be in one sum or by way of annuity. If the new Companies are consolidated, the Board is to consist of the Directors of the new Companies and of the persons appointed by the Board of Trade. Certain officers are to be continued as officers of the consolidated Company; and those displaced are to be compensated as the Arbitrator may direct. According to the next clause, the consolidated Board may elect a Chairman from their body, or one who is not a Director or a shareholder of any of the Companies. He is to hold office for three years, at such salary as they may think fit.

Clauses 11 and 12 set forth the remuneration and the powers of the Arbitrator. He is to receive such remuneration as the Lord Chancellor for the time being may determine; and he may appoint such officers and may call in such skilled advice as he thinks necessary. All the costs, charges, and expenses of the arbitration, including those of the parties which he may allow, are to be met by the creation of so much "A" stock as will be necessary for the purpose. With regard to the powers, duties, and authority of the Arbitrator, the following provisions are to apply: (*a*) He may consider and make such alterations in the existing regulations as to water supply of the Companies as he may think necessary for the prevention of waste and for the due efficiency and wholesomeness of the supply. Such amended regulations are to be of the same force and effect as those now existing; and they may, subject to the allowance of such compensation as he may think fit, vary and increase the obligations of any of the Companies as regards high pressure, so as to make the action of each Company alike. (*b*) He is to consider the existing charges of the Companies, and place them all on a uniform scale; and he is to award such amount of stock to any Company affected, in compensation for such reduction, as he thinks fit. (*c*) The final award of the Arbitrator is to have all the effect of an Act of Parliament; and, except as by the Act or by the award of the Arbitrator expressly varied, all the provisions of the existing General Law and the Special Acts of the Companies are to continue in force. He may issue interim awards. (*d*) The Arbitrator may apply the moneys received from the Water Companies by the Chamberlain of the City of London either in providing for an equalization of rates, or otherwise.

Clause 13 makes provision for the appointment of a Water Referee. The Arbitrator may, if he thinks fit, and the Board of Trade shall thereafter from time to time, appoint a Water Referee to hear and determine all complaints by Local Authorities against the Water Companies; and the Referee may direct what, within their parliamentary powers, is to be done by the Companies, and may allow all parties before him such costs as he deems commensurate. It is provided that all decisions of the Referee shall be subject to appeal to the Court of Appeal. The case is to be heard on a shorthand note of what has taken place before the Referee; and the Court may make such order thereon as they shall think just. The salary of the Referee is to be fixed by the Lord Chancellor, and paid by the Water Companies *pro ratâ* with their receipts.

The final clause provides for the creation of a reserve fund. The Water Companies are to apply any surplus profits which they may have after payment of the prescribed interest and dividends on their stocks to the formation of a reserve fund not exceeding, with any interest accruing thereon from time to time, 10 per cent. of their "A" and "B" capital; and when the reserve remains at 10 per cent., the rest is to be applied in reduction of the charge for water for public and domestic purposes, as well as for that supplied by meter.

CAPE TOWN WATER SUPPLY.

Proposed Additional Reservoir.

According to the papers brought by a recent mail, the great storage reservoir which has been under construction on Table Mountain since January, 1893, has been completed; and the people of Cape Town have now under consideration the question of commencing at once a similar undertaking for further increasing the quantity of water impounded. The new reservoir, which has been constructed from the designs and under the superintendence of Mr. T. Stewart, the Engineer appointed by the Town Council, is situated at the upper end of the gorge known as the Waai Kopje Vlei. It is formed by a masonry dam 123 feet high as measured from the outlet; and at this level it has a length of 800 feet. The top water-level of the reservoir is 2404 feet above the sea-level; and the drainage area above the dam, inclusive of the surface of the reservoir, is 670 acres. The maximum depth of water is 122 feet; but one-half of the entire bulk of water (which when the reservoir is full is about 225 million gallons) is contained in the top 18 feet. As the water flows into the service reservoirs, the fall is utilized for driving turbines for the supply of electric light to the town. The report which Mr. Stewart has presented to the Council does not state the cost of the reservoir; but it appears that it was originally estimated that one capable of impounding 130 million gallons of water, with a masonry wall 112 feet high, would cost £92,000. After the work was commenced, the larger scheme was decided upon. Though this is a considerable addition to the available water supply, it is pointed out that the ratio of increased demand is still more so. In a letter he has addressed to the local papers, the Mayor (Sir John Woodhead) states that the yearly demand for water has steadily increased in the last twenty years. Last year's sales were 127,900 gallons per day in excess of those in the preceding year. The revenue in 1877 was £4318; in 1896 it was £19,730; and it is expected to reach £21,500 by the end of the current twelve months. Sir John anticipates that the demand will be almost doubled in the first two or three years after the completion of the drainage works now in progress. In view of these facts, it is proposed to proceed with the construction of another reservoir. Mr. Stewart recommends that this should be built on the lower plateau of Table Mountain—a site suggested by the late Mr. Gamble, Hydraulic Engineer to the Colony. A reservoir could be constructed capable of containing 300 million gallons, and requiring a masonry wall 64 feet high, the cost of which would be about £192,000; or a reservoir capable of holding 200 million gallons, and requiring a masonry wall 54 feet high, the cost of which would be about £112,000. If it should be decided to make the larger reservoir, the sum of £112,000 would be sufficient to build the dam to the height of 40 feet, at which the quantity of water impounded would be 80 million gallons. Unfortunately for the success of the enterprise, an opinion prevails among a section of the ratepayers that the new reservoir is needed quite as much for the purposes of the electric light undertaking as for the supply of water for consumption. A meeting of ratepayers to sanction loans for the water-works and numerous other undertakings rejected nine out of fourteen schemes which were put before them. Among the rejected were proposals for extending the electric light and building the new reservoir. The latter was only lost by one vote; but this was clearly traceable to the connection of the undertaking with the electric lighting scheme, which is in bad odour. The same meeting voted about £41,500 for money spent on the existing works in excess of the estimate; but successful opposition was shown to an item of £10,600 for expenses incurred on water-works account prior to the floating of the last loan; the objection in this case being that the amount ought to have been included in the former loan. A poll of the ratepayers was to be held, with a view to obtaining approval of the rejected schemes.

Gas-Works Extensions at Bingley.—The Bingley Town Council have accepted the tender of Messrs. R. & J. Dempster for adding two lifts to one of the gasholders. Speaking on the subject at the meeting of the Council yesterday week, the Chairman of the Committee (Mr. J. Gatecliff) stated that the question of the extension of the works had not come upon them suddenly. During the past winter, they arrived at the conclusion that they would have to do something at once. At the present time they had a storage capacity of 400,000 cubic feet, which only gave them about three-quarter of a day's storage in advance. The present extension, which would cost £2200, would give them accommodation for an additional 150,000 cubic feet. Later on they would require a new gasholder and a retort-house. They had a sufficient amount in the reserve fund to pay for the extension.

The Taunton Town Council and the Gas Company.—At a recent special meeting of the Taunton Town Council, the question of opposing the Bill of the Taunton Gas Company was under consideration. At a previous meeting, Messrs. Sharpe and Co., Parliamentary Agents, were instructed to consider the provisions of the Bill, and ascertain if there were any to which the Council might raise objection. Messrs. Sharpe now presented their report, in which they recommended the Council to oppose the clauses of the Bill relating to the price to be charged for gas and the rights of the Company to break up the roads. These objections were placed before a Committee of the Company, with the result that a conference took place between them and the Emergency Committee of the Council, at which the objections were fully discussed. The Emergency Committee reported that the principal objections to the Bill were that it proposed to fix a standard price for gas and a sliding-scale for dividends. The standard was 3s. 9d., at which figure the maximum dividend would not exceed 8 per cent.; but if the Company charged 3s. 6d., which was now the price after deducting discount to the smallest consumer they would be able to pay a dividend of £8 12s. per cent. The Company were willing to allow clauses to be inserted to the effect that the shareholders should not be entitled to increased dividend so long as the net price to the smallest consumer was not less than 3s. 6d. per 1000 cubic feet. Objection was also taken to the clauses permitting them to interfere with the roads and the sewers; and the Company gave an undertaking to fall in with the suggestion of the Council in this matter. A letter was read from the Solicitors to the Company agreeing to meet the whole of the objections on condition that the Council did not petition against the Bill. The Committee recommended the Council to endorse this arrangement; and it was unanimously agreed to.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh appointment has now been made public. In another column will be found an account of the proceedings at the public meeting of the Commissioners on Monday. A perusal of the report will explain the great desire on the part of the Commissioners to maintain secrecy a week ago. The Commissioners were hopelessly divided on the subject. It is a pity that, out of an endeavour to secure unanimity, there should have arisen such pronounced antagonism. But so it was; and the state of matters which produced this result was of the Commissioners' own making, in the resolution to do away with speeches with a view to reaching a unanimous decision. Unanimity is very desirable on such occasions; but it may be possible to sacrifice too much to obtain it. The Commissioners, I am afraid, did so. I cannot disabuse my mind of the belief that, it being known that there was a sharp division of opinion among the Commissioners, each of the two parties thought they would carry the day; and when the agreement was made, both believed that their man would walk in. Of course, they both could not; but, as a matter of fact, they were as near doing so as possible, on account of the equal vote. When this state of equality was reached, there was then no escape from the settlement of the question but the casting vote of the Lord Provost, whose man was bound to succeed. The Commissioners' Act of Parliament obliges him to give his casting vote; and he could not avoid doing so. I emphasize this, because the supporters of the other candidate seemed to think that they had a grievance, on account of the election having been made by a casting vote. But their agreement being that they would support the candidate having the greatest number of votes, they had no grievance. I condemn their attitude in the public meeting on Monday. A compact is binding upon every man making it. The compact in this instance might not have bound on Monday those who were not present on Friday; but it is to be noted that the only one of that class who spoke on Monday (Mr. J. G. Holburn, M.P.) held it to be binding upon him, although, he confessed, he would have voted on the other side had he been present on Friday. All the opposition to the successful man came from those who were present on Friday, and entered into the agreement. The Commissioners thus suffered great loss of dignity through the action of the section of them who endeavoured to go back upon their word. It was specially humiliating to find that the man who started the washing of the dirty linen was the person who, on Friday, sat silent—neither uttering a word nor giving a vote. I am not sure, however, but that all the difficulty would have been avoided had the meeting on Friday been an open one. The hole-and-corner element which was imported into the proceedings by holding the meeting in private, could scarcely have been productive of benefit to any of the candidates, because it was bound to come out that a vote had been taken, and what the vote had been. It is quite customary to hold a preliminary meeting in private, and then in public meeting to make the appointment unanimous; but it is not usual to take a vote in private which goes into the minutes. The procedure was thus a little off; but that would not have mattered if all the Commissioners had stood by their contract. It was there that the trouble came in; and it was greatly to be regretted, because it led to the engendering of bad temper. But even this, again, might have been avoided, because the bad temper arose on account of the Lord Provost unfortunately dragging in the name of Mr. Waterston. This gentleman was no doubt the head and front of the opposition; but on Monday he was quiescent until he was pulled up. It was a nasty rumpus. I lay the whole blame for it upon those who were opposed to Mr. Herring. Barring the introduction of Mr. Waterston's name, the Lord Provost, I consider, could not have acted otherwise than he did on Monday. The agreement of Friday was not his proposal; and if it were the root of all the evil, he cannot be held responsible for it, except only in a secondary degree. But as to Monday, his Lordship was certainly entitled to form an opinion in favour of a particular candidate, as were all the other Commissioners; and having formed it, he was justified in supporting it to the best of his ability. He did no more. It may be a slight disappointment to Mr. Herring that there was a scene at his election; but there was nothing in the conduct of his supporters which need annoy him. I do expect that when he arrives in Edinburgh to take up his duties, so far as he is concerned, bygones will be bygones, and that he will receive the hearty support of those who were not his supporters. If he does not, it will be very discreditable.

Mr. Herring, when he comes to Scotland, will find himself in a peculiar position in one respect. He is himself the inventor of an oil-gas process; and there is at present being constructed in the Edinburgh works an installation of carburetted water-gas plant, by Messrs. Humphreys and Glasgow. It would be only natural that he should prefer to work his own patent; but he will not be able to do this in Edinburgh in the meantime. There are, however, the works in Leith, where he might introduce his own patent. There is one thing about the appointment that I do not like, and which I hope the Commissioners will reconsider. That is the condition that Mr. Herring shall devote his whole time to the service of the Commission. I would wish the Commissioners to look upon the matter in this light—that to confine their Engineer to routine duties, is not the best way to keep him abreast of the times; and that there is nothing which makes an engineer keep up to the mark equal to allowing him to engage in consulting practice. After a little this restriction might be withdrawn; and I am certain that if, within reasonable limits, Mr. Herring were allowed to do outside work, the interests of the Commissioners would be benefited and not in any way prejudiced.

The Ward Committees in Stirling met on Monday night, and resolved that, in respect that the Corporation are proceeding with their Bill for the authorizing of the gas transfer, they should oppose it; and power was given to a Committee to proceed with the opposition in Parliament. Subscriptions to enable them to go to Parliament are to be solicited; and as the intention of the Committee is to vindicate the principles of municipal institutions and representative government, it has been resolved to appeal for outside assistance. I fancy it will not be difficult to spend all they will get; and any subscriptions they do obtain will not be given for the vindication of representative government, but for the subversion of it. Meantime, the prospect of the transfer proceeding rather

brightens than otherwise. The opposition seem to be losing ground; and the longer it is looked at, the position of those who favour the transfer is getting stronger. They have also been reinforced in two ways. Bailie Lawson, who had been on a visit to Peru, has returned and lent his influence to the party of transfer. The other reinforcement comes from a quarter where, until recently, it would not have been looked for. Professor A. B. W. Kennedy, of London, has been called in by the Corporation to advise them as to an installation of electric lighting. He was in Stirling on Wednesday, and gave it as his opinion that any installation which they might fit up should be within the gas-works, or as near to them as possible. All the corporations, he said, for whom he had prepared an electric light installation had the gas-works in their own hands. This was almost more than a hint that in Stirling they ought also to acquire the gas undertaking.

The Glasgow Corporation Gas Engineer (Mr. William Foulis) has been authorized to lay down additional piping at Clydebank for the proper supply of that district, at an estimated cost of £2000. He is also to put down a new 18-inch main, at an estimated cost of £3200, for improving the supply of gas to the districts of Tollcross and Shettleston. The three districts named are all beyond the municipal boundaries. When the tenders for the Clydebank job were brought under the consideration of the Sub-Committee on Gas-Works, it was agreed to accept the offer of Messrs. R. Laidlaw and Son for the supply of the pipes, and that by Mr. W. Pollock for excavating and refilling the trench. The Sub-Committee also agreed to contract with Messrs. Laidlaw for supplying the pipes required for the new main in the Tollcross and Shettleston districts, providing they were willing to do so at the same prices as those specified in their tender for the Clydebank main.

I mentioned, several weeks ago, that Mr. D. M. Stevenson, of the Glasgow Town Council, had tabled a motion proposing to disjoin the gas and electric lighting interests, which have hitherto been attended to by one Committee. The motion was on the billet for Thursday's meeting; but it was not reached. Had it been, I understand that Mr. R. M. Mitchell, the Convener of the Gas and Electric Lighting Committee, was prepared to state that he would offer no opposition to the proposal, as he is of opinion that both departments would probably be best served by separate Committees. He considers that there is quite enough work in connection with the gas department for one Committee to do. In this, I am sure he is right. Whether the electric lighting department will be better promoted by a separate Committee than it has been by the Joint Committee, is another matter.

The Corporation of Forfar have now had their new photometer fitted up and brought into use. It was reported to them on Monday that the average of various tests which had been made in the preceding week, showed the gas to be of 23·6-candle power. The Forfar Gas Act requires gas of 18-candle power.

Gravesend Water Bill.—The Gravesend Town Council, having, as already mentioned, been defeated at the poll in respect of their proposal to acquire the local water-works, have passed a resolution to co-operate as far as possible with the Northfleet District Council in opposing the Gravesend and Milton Water Company's Bill.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Feb.* 20.

Sulphate of Ammonia.—In the early part of the week, the market was quiet. There being second-hand parcels offering, business was done at a decline of 1s. 3d. to 2s. 6d. per ton. Within the past few days, however, second-hand stuff having been disposed of, there has been a firmer tone; and closing quotations are £7 15s. to £7 16s. 3d. per ton delivered f.o.b. at the ports. The demand is still mainly from dealers, to cover contracts. There is a fair inquiry from consumers. But their requirements are not urgent; and they have been kept quiet by low quotations in the forward position. London May-August delivery is quoted £7 10s. per ton, Beckton terms. For March-April delivery, ordinary terms, £7 17s. 6d. per ton is now asked, though below the equivalent of this price is being quoted on the Continent.

Nitrate of Soda.—There has been an improvement in spot demand; but quotations remain 8s. 1½d. per cwt. for ordinary, and 8s. 3d. per cwt. for fine quality.

LONDON, *Feb.* 20.

Tar Products.—During the past week, probably through the better dissemination of information, the values of several products have been more firmly established, and others are somewhat increased. Important business has been done in carbolic acid; prices ranging from 2s. 4d. to 2s. 6d. for 60's. Solvent naphtha has been considerably dealt in, at from 1s. 7d. to 1s. 8½d. Pyridine, although a limited article, has been put up 1s. per gallon on the week. Pitch would appear to have touched its lowest point, and buyers show greater anxiety to cover their forward requirements; so, with a little care on the part of makers, it seems better for forward. Anthracene is quiet.

The following prices may be taken as representing the week's business: Tar, 15s. to 22s. Pitch, 23s. Benzols, 90's, 3s. 1d.; 50's, 2s. 9d. Solvent naphtha, 1s. 7½d. Crude, 30 per cent., naphtha, 1s. 1½d. Creosote, 1⅜d.; liquid, 1¼d. Heavy oils, 40s. to 45s. Carbolic acid, 60's, 2s. 6d. Naphthalene, 65s.; drained salts, 30s. Anthracene, "A" quality, 8½d.; "B," 7½d.

Sulphate of Ammonia, while being freely taken up, shows no improvement in price, and ranges anywhere between £7 10s. and £7 15s. per ton, less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A continued slackening off in the demand is reported in the coal trade here; and though pits are still generally running five days per week, the orders coming forward are scarcely in all cases sufficient to take away the present production. For the best qualities of round coal, prices are scarcely maintained at recent full rates. At the pit mouth, 10s. to 10s. 6d. per ton represents about the average for best Wigan Arley; with seconds Arley and Pemberton four-feet, 8s. 6d. to 9s.; and common house coal, 7s. to 7s. 6d. As regards steam and forge coals, the business coming forward does not show any appreciable falling

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 400).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	24–26	..	4 0 9
100,000	10	,,	7½	Do. 7 p. c.	17½–18½	..	4 1 1
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	108–111	..	4 10 11
200,000	10	29 Oct.	5	Belgrano (B. Ayres), Limited	9¾–10½	..	4 17 7
100,000	Stck.	30 Dec.	5	Do. 5 p. c. Deb. Stk	102–105	..	4 15 3
200,000	5	12 Nov.	6½	Bombay, Limited	6½–7½	..	4 6 8
40,000	5	,,	6½	Do. New, £4 paid	5–6	+½	4 6 8
380,000	Stck.	13 Aug.	12	Brentford Consolidated	293–295	..	4 1 4
240,000	,,	,,	9	Do. New	227–232	..	3 17 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	140–145	..	3 9 0
159,375	,,	11 Dec.	4	Do. 4 p. c. Deb. Stock.	130–134	..	2 19 9
220,000	Stck.	16 Sept.	11½	Brighton & Hove Original	270–275	..	4 3 7
208,820	,,	,,	8½	Do. A Ord. Stk.	198–203	..	4 3 9
933,500	Stck.	28 Aug.	5	Bristol, 5 p.c. max.	130–135	..	3 14 1
420,000	20	15 Oct.	11½	British	56½–57½	..	3 18 3
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	24–26	..	4 8 6
71,000	10	,,	8½	Do. 7 p. c.	19–21	..	4 0 11
500,000	10	15 Oct.	6	Buenos Ayres (New) Limited	9½–10½	..	5 14 3
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	101–103	..	5 16 6
150,000	20	14 July	8½	Cagliari, Limited	29–31	..	5 6 5
100,000	10	30 Sept.	6	Cape Town & District, Ltd.	15½–16½	..	3 12 9
50,000	50	3 Nov.	6	Do. 6 p. c. 1st Mort.	57–59	..	5 1 8
550,000	Stck.	15 Oct.	13½	Commercial Old Stock	338–343	..	3 18 8
165,000	,,	,,	10½	Do. New do.	255–260	..	4 0 9
165,000	,,	11 Dec.	4½	Do. 4½ p. c. Deb. do.	150–155	..	2 18 0
800,000	Stck.	30 Dec.	13	Continental Union, Limited.	260–265	..	4 18 1
200,000	,,	,,	10	Do. 7 p. c. Pref.	215–220	..	4 10 11
51,600	Stck.	28 Aug.	14	Croydon Com'cial A 10 p. c.,	315–320	..	4 7 6
163,400	,,	,,	11	Do. B 7 p. c.,	250–255	..	4 6 3
535,000	Stck.	28 Aug.	5½	Crystal Palace Ord. 5 p.c. Stk	140–145	..	3 12 5
60,000	,,	,,	5	Do. 5 p. c. Pref.	140–145	..	3 9 0
486,090	10	29 Jan.	11	European, Limited	25½–26½	..	4 3 0
354,260	10	,,	11	Do. £7 10s. paid	17½–18½	..	4 6 11
5,896,590	Stck.	12 Feb.	12¾	Gaslight & Coke, A, Ordinary	313–318†	−2	4 0 2
100,000	,,	,,	4	Do. B, 4 p. c. max.	108–113*	..	3 10 10
665,000	,,	,,	10	Do. C, D, & E, 10 p. c. Pf.	307–312*	+2	3 4 1
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	145–150*	..	3 6 8
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	210–215*	..	3 9 9
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	207–212*	..	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	305–310*	..	3 4 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	177–182*	..	3 5 11
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk.	137–142	..	2 16 4
294,850	,,	,,	4½	Do. 4½ p. c. do.	150–155	..	2 18 1
908,000	,,	,,	6	Do. 6 p. c. do.	207–212	..	2 16 7
70,000	10	29 Oct.	6	Hongkong & China, Limited	12–13	..	4 12 4
3,800,000	Stck.	12 Nov.	12	Imperial Continental	218–223	−3½	5 7 7
376,400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	99–102*	..	3 18 5
473,600	Stck.	12 Feb.	3½	Do. 3½ p. c. Deb. Stk ,,	104–107*	..	3 5 5
75,000	5	11 Dec.	6	Malta & Mediterranean, Ltd.	5⅞–6⅛	−¼	4 16 2
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	111–115	..	4 6 11
250,000	100	,,	4½	Do. 4½ p. c. Debs.	109–111	..	4 1 1
541,920	20	12 Nov.	5	Monte Video, Limited	15½–16½	..	6 1 3
150,000	5	26 Nov.	8	Oriental, Limited	8½–9	..	4 8 11
135,000	5	,,	8	Do. New, £4 10s. paid	7½–8	..	4 10 0
15,000	5	,,	8	Do. do. 1879, £1 paid	1½–2	..	4 0 0
60,000	5	16 Sept.	7	Ottoman, Limited	5–5½	..	6 7 3
420,000	100	2 Nov.	6	People's Gas } 1st Mtg. Bds.	100–105	..	5 14 3
500,000	100	1 Dec.	6	of Chicago } 2nd Do.	100–105	..	5 14 3
250,000	10	30 Sept.	10	San Paulo, Limited	13–14	..	7 2 10
5,475,000	Stck.	13 Aug.	5½†	South Metrop., 4 p.c. Ord.	148–151	+1	3 9 6
850,000	,,	14 Jan.	5	Do. 5 p. c. Deb. Stk.	169–172	..	2 18 2
60,000	Stck.	16 Sept.	11½	Tottenham & Edmonton, A	280–290	..	3 19 4
60,000	,,	,,	8½	Do. B	190–200	..	4 5 0
182,380	10	30 Dec.	10	Tuscan, Limited.	14–15	..	6 13 4
149,900	10	2 Jan.	5	Do. 5 p. c. Debs. Red.	101–103	..	4 17 1
				WATER COMPANIES.			
746,159	Stck.	30 Dec.	10½	Chelsea, Ordinary	333–338	..	3 2 2
150,000	,,	,,	5	Do. 5 p. c. Pref.	175–180	..	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	158–162	..	2 15 6
175,785	,,	30 Sept.	4½	Do. 4½ p. c. Deb. Stock	162–167	..	2 13 11
1,720,560	Stck.	15 Oct.	7	East London, Ordinary	225–230	−7	3 0 10
654,740	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	162–167	..	2 13 11
225,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	106–108	+1	2 15 7
700,000	50	11 Dec.	7½	Grand Junction, 10 p.c. max.	112–117	−5	3 4 1
295,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	150–155	..	2 11 7
708,000	Stck.	12 Feb.	12	Kent	340–345*	..	3 9 7
160,000	,,	,,	7	Do. New, 7 p. c. max.	212–217*	..	3 4 6
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	275–280	..	3 8 4
406,200	100	,,	7½	Do. 7½ p. c. max.	222–227	..	3 6 1
350,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	150–153	..	2 12 3
500,000	100	12 Feb.	13	New River, New Shares	418–423*	..	3 1 5
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	152–155	..	2 11 7
902,300	Stck.	30 Dec.	6	S'thwk & V'xhall, Ordinary	157–162	+2	3 14 1
126,500	100	,,	6	Do. Do. 7½ p. c. Max.	150–155	..	3 17 5
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	175–180	..	2 15 7
1,019,585	,,	30 Sept.	4	Do. 4 p. c. A Deb. Stk.	146–149	−2	2 13 9
1,155,066	Stck.	11 Dec.	10	West Middlesex	310–315	−2	3 3 6
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	163–168	..	2 13 7

† Next dividend will be at this rate. *Ex div.

off; but supplies are more plentiful, and prices not more than steady at late quotations. From 6s. to 6s. 6d. represents about the average figures for ordinary qualities of steam coal at the pit. Supplies of engine fuel are becoming still more excessive; and for some common sorts, specially low quotations have been made to effect clearances. Common slack is readily obtainable at 2s. 9d. to 3s. 3d. per ton at the pit; medium sorts average 3s. 9d. to 4s. 3d.; and best qualities, about 4s. 6d. to 4s. 9d. Business continues moderate for shipment; but common steam coal is still to be bought at 7s. 6d. to 7s. 9d. per ton, with better qualities quoted 8s. to 8s. 3d., delivered at the Mersey ports.

Northern Coal Trade.—There has been a better demand for coal in the North, though it is not yet sufficient for steam coals to give full work to the whole of the collieries producing that class of fuel. There have been, however, in the last few days some inquiries for coal for the Turkish fleet, which may lead to large orders. Best Northumbrian steam coals are steady; the price varying from 7s. 9d. to 8s. per ton f.o.b. for prompt delivery. For delivery over the shipping season, 1s. per ton above these prices is asked, and has been paid in the case of one small lot already sold. Steam smalls are very plentiful, and may be had at from 2s. 9d. to 3s. per ton f.o.b. In the gas coal trade, the demand is still very heavy; and some of the large collieries have their output fully taken up for a month to come. There are now many contracts for gas coals in the market; and one or two have been settled. It is found that there are advances in the supply for Gothenburg, Stockholm, and one or two other places sufficient to make the price for the coal at the pit about 6d. per ton above that paid for similar contracts last year. This conclusion is based on the continuance of rates of freight at the same average as last year, for most of these contracts are taken at a price which includes the freight. Gas coke is now in slightly lessened make, and is unaltered this week in price.

Scotch Coal Trade.—Trade continues healthy. There is a ready market for all classes, and prices are keeping well up, except for splint, which is now plentiful, and with a tendency to weakness in the market. With the opening of the Baltic trade, which may be almost immediately, or may not be till April, an advance both in demand and prices is expected. The prices quoted are: Main, 6s. 9d. per ton f.o.b. Glasgow; ell, 7s. to 7s. 3d.; and splint, 7s. 3d. to 7s. 6d. The shipments for the week amounted to 127,342 tons—a decrease of 15,020 tons on the preceding week, but an increase of 18,974 tons over the corresponding period of last year. For the year to date, the total shipments have amounted to 780,639 tons—an increase over the same period of last year of 41,086 tons.

Gas-Works Extensions at Droitwich.—The Droitwich Corporation have made application to the Local Government Board for a Provisional Order, to enable them to extend the gas-works; and an inquiry was held by Mr. F. H. Tulloch, one of the Board's Inspectors, last Thursday. It was stated that the Council desired power to acquire land to build a new retort-house, coal-stores, and purifiers, and to enlarge the mains; the cost being estimated at £4500.

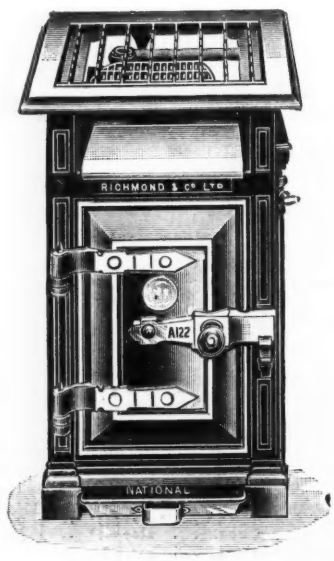
Projected Extension of Messrs. Fletcher, Russell, and Co.'s Works.—Messrs. Fletcher, Russell, and Co. are in treaty for the acquisition of 16 acres of ground at Warrington, opposite the Ship Canal Docks, for the extension of their works in Thynne Street, which are too small for the Company's present business. It is also intended to construct railway sidings to the works.

The Sale of Sulphate of Ammonia at Heywood.—It has been pointed out to us that the particulars contained in the paragraph headed "The Sale of Sulphate of Ammonia by the Bury Corporation," in the last number of the "JOURNAL," did not refer to that town, but to Heywood, where Mr. W. Whatmough is the Corporation Gas Manager. We regret the mistake, for which, however, our local correspondent is responsible. We learn that some of the statements reported in the paragraph have been under the consideration of the Gas Committee; and that it is the intention to deal further with the matter at the next meeting of the Heywood Council.

Reduction in the Price of Gas at Alresford (Hants).—Some time ago, the Directors of the Alresford Gas Company decided to reduce the price, as from Sept. 30 last, from 5s. 6d. to 5s. per 1000 cubic feet, with a further reduction of 6d. per 1000 feet to consumers of 10,000 cubic feet per quarter. When the present Manager (Mr. J. Millet) was appointed, 4½ years ago, the price was 5s. 10d. per 1000 cubic feet all round. Besides the concession the Directors have been enabled to make to the consumers, they have reduced the debt by £100, and paid £200 for altering the Manager's house and laying 700 yards of new mains; and they hope to clear off £50 more of the debt this year.

The Bolton Corporation and Gas Deposits.—At a recent meeting of the Gas Committee of the Bolton Corporation, it was resolved that the tenant or occupier of every public-house or beerhouse held under a brewer should be required to give security in the way of a deposit on his gas account. It was in February, 1889, that the Corporation passed a resolution enforcing deposits; but for some considerable time the practice has been abolished, except in doubtful cases. The action of the Gas Committee in re-enforcing this security against "tied" houses has caused great commotion among the licence holders in the town; and the matter is to be discussed at the next meeting of their trade organization.

The Proposed Additional Works of the New River Company.—The Engineer to the New River Company (Mr. J. Francis, M.Inst.C.E.) has deposited in the Private Bill Office of the House of Commons an estimate amounting to £970,000 as the capital required to be expended by the Company in the event of their Bill of the present session receiving the sanction of Parliament. The whole of the capital is proposed to be spent in giving the Company an independent line of pipes for the purpose of conveying the proportion of stored water to which they will become entitled under the Staines Reservoirs Act of last year into a new service reservoir at Fortis Green and thence into their limits of supply. In the form in which the Staines Reservoirs Act was passed last session, the Company can only receive their proportion of stored water through the mains of the West Middlesex Company and the Grand Junction Company.



RICHMOND & CO., LTD.

WARRINGTON & LONDON.

"NATIONAL"

Prepayment Meter Cooker.

VERY STRONG,

OF GOOD APPEARANCE,

AND WELL PROPORTIONED.

Fitted with REMOVABLE GRILLING and BOILING BURNERS, AND PATENT WHITE ENAMELLED CROWN-PLATE.

Reduced Price,
from March 1 next, 36s.

Northam Water Supply.—The Northam Urban District Council have invited Mr. Baldwin Latham to visit the district and submit a proposal for the supply of water to the district by a series of sectional schemes. Mr. Latham has already sent in two—one by gravitation, and the other by pumping; but both have been rejected on account of the cost. The question has been under discussion for a very long time; and this latest movement is not regarded as an indication that it is now approaching settlement.

The Progress of Gas Consumption in Manchester.—The Chairman of the Gas Committee of the Manchester Corporation (Mr. Gibson) recently stated, in illustration of the progress of the gas undertaking in Manchester, that despite the advance of the electric light, the total consumption of gas from April 1 to Dec. 31 last was 2,781,112,000 cubic feet, as compared with 2,506,513,000 cubic feet in the corresponding nine months of the previous year—an increase at the rate of 10·95 per cent. The consumption from April 1, 1896, to the 9th inst. was 3,476,794,000 cubic feet, compared with 3,116,809,000 cubic feet in the corresponding period of the previous municipal year. This represents an increase at the rate of 11·55 per cent.

The Proposed New Works for the Harrogate Water Company.—The Engineer to the Harrogate Water Company has deposited in the Private Bill Office of the House of Commons an estimate of £71,000, as the amount of new capital which will have to be expended by the Company in the event of their Bill of the present session receiving the sanction of Parliament. The whole of this capital will be expended upon new works, which are required to meet the rapidly increasing demand for water in the district. The works comprise a reservoir, to be formed by means of an embankment across the Scargill Beck, and an alteration of the levels of the existing Beaver Dyke reservoir, together with all the necessary conduits for carrying the water from the new works to the area of supply.

Sales of Stocks and Shares.—The following stocks and shares have lately been sold by public auction: A parcel of £200 of consolidated "A" stock (*ex div.*) of the Croydon Gas Company, for £679 10s.; and £125 of consolidated "B" stock, for £320. These are by far the highest prices yet obtained for this Company's stock. Last Tuesday, nine £10 shares in the Bury St. Edmunds Gas Company (1849 capital) realized an average of £28 each; and seven similar shares (1859 capital), £20 10s. each. Ten £5 shares in the Cromer Gas Company fetched £7 15s. each. Eight £10 shares in the North Walsham Gas Company realized £10 5s. apiece. Twenty £10 original shares in the Hythe and Sandgate Gas Company changed hands at £8 10s. each for ten, and £8 15s. each for the remainder. A parcel of ten fully paid £10 shares in the Thetford Gas Company were sold last Thursday at Bury St. Edmunds at £13 15s. per share.

The Arundel Corporation and the Gas Company.—At the last meeting of the Arundel Corporation, certain changes suggested by them in the Bill promoted by the Arundel Gas Company were under consideration. At a previous meeting, a motion had been carried to the effect that the Company should be asked to make the proposed initial price 3s. 9d. nstead of 4s. 3d. To this the Company replied that they were willing to put it at 4s. It was pointed out that the average charge for gas in Arundel for the past fifteen years had been 3s. 10d. Eventually the matter was left to the arbitrament of Mr. E. J. Mostyn, who is to decide what the price is to be. Before making his award, he will probably consult with the Duke of Norfolk, who is anxious to have the difference settled amicably between the parties. Another matter in dispute was as to the user of the bridge for carrying the gas-pipes over the river; and the Company have agreed to pay 1s. a year for the privilege—six months' notice on either side to be given to determine the easement. A further concession made by the Company is a reduction of 5 per cent. in the price of gas used for public lighting and employed for driving the engine at the sewage outfall works.

Objections to the Leeds Improvement Bill.—The feeling in the Washburn Valley against the proposals contained in the water-works clauses of the Leeds Improvement Bill is growing as their nature is becoming better known. At a meeting recently held at Fewston, a discussion arose as to the steps to be taken in connection with the matter. It was stated that the proposals would very seriously affect the welfare of the district, as they must inevitably result in the depopulation of the whole of the villages. Resolutions were passed strongly protesting against any bye-laws or restrictions being put upon any owner of land outside the Corporation property; and also against granting powers for the compulsory purchase of land where it is not absolutely necessary for the storage of water.

Employers' Liability Bill.—The Injuries to Workmen (Employers' Liability) Bill, introduced by Sir Arthur Forwood in association with Mr. Warr, Mr. Tomlinson, and Sir E. Hill, to which reference was made in the "JOURNAL" for the 9th inst., provides that common employment shall not be a defence to an action for compensation in case of injury; that the failure to take reasonable precautions which would avoid or mitigate risk of injury to health in dangerous callings shall constitute negligence on the part of an employer; and that the principal employer shall be liable to the workmen for negligence on the part of sub-contractors. As an alternative, permission is given to employers and workmen to enter into agreements of service, providing for compensation to the latter in the case of all accidents however caused (save the wilful default of the injured workmen), with the limit to the damages specified in the Bill. In the event, however, of injury arising through the neglect of an employer, the injured workman may forego his rights under an agreement, and pursue his remedy against his employer as if the Act had not passed.

The Corporation of Leeds have arranged to float a new loan in London next month for £500,000. It will bear interest at 2½ per cent. per annum, and be redeemable at any time after December, 1926. The money obtained by this issue will be mainly expended upon gas-works extensions, tramways, and sanitary improvements; but a small portion will be devoted to the redemption of some existing loans bearing a higher rate of interest.

The Davis Gas-Stove Company, Limited, have just supplied to Hong Kong, for the principal club there, a large range of highly-finished gas hot closets, with carving-table tops, 28 feet in extent, and with all the latest up-to-date fittings in polished copper and brass. The apparatus is estimated to do all the carving and plate-warming necessary for a dinner of 120 people, served by 25 waiters; and when put on rails it scaled a little under four tons.

The firm of Sir Titus Salt, Bart., Sons, and Co., Limited, are making a new departure in regard to their tenants at Saltaire, by adopting the system of letting out gas-stoves on hire. Arrangements have been made by the firm with Messrs. Richmond and Co., of Warrington, to supply the stoves. The latter have recently held an exhibition in the local Institute, during the course of which Mrs. Middleton gave a number of cookery demonstrations. These were very popular; and last Friday week, several of the ladies who had attended them presented Mrs. Middleton with a handsome morocco writing-case and a bouquet of flowers.

It will be seen by an announcement which appears elsewhere, that Mr. Alfred Richards will conduct on the 2nd prox. an important sale of gas and water stock. It will comprise a new issue of debenture stock of the Lowestoft Water, Gas, and Market Company, and large parcels of stock of the Tottenham and Edmonton, Barnet, West Ham, Ilford, Tunbridge Wells, and other Companies, brought into the market chiefly in consequence of the death of the holder. On the following Tuesday (the 9th), he will submit to public competition the £15,000 of "C" stock which, as stated in the report noticed elsewhere, the Directors of the Tottenham and Edmonton Gas Company have decided to issue.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 65,095.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

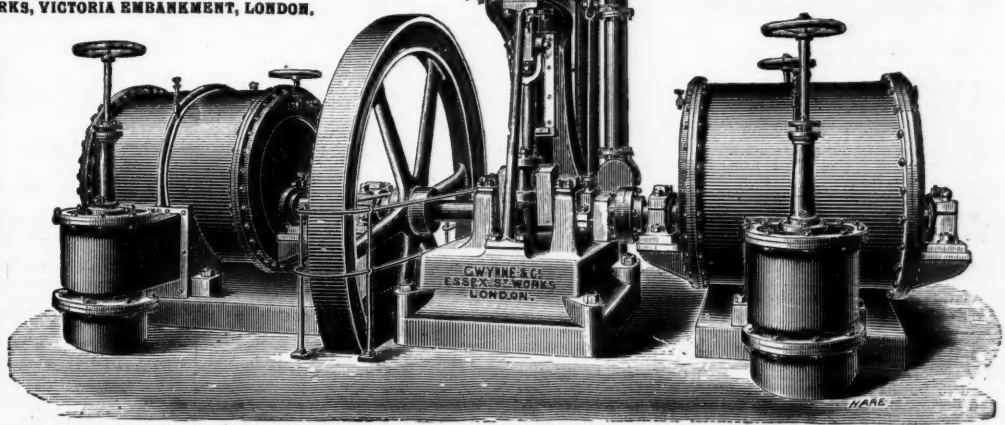
They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.



Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
JOHN WM. O'NEILL, Managing Director,
Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. in use in most Continental Gas-Works, and in more than 300 British Gas-Works.
ANDREW STEPHENSON,
182, GRESHAM HOUSE,
OLD BROAD STREET,
LONDON, E.C.
Telegrams: "Volcanism, London."

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE wanted.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

TUBES for Gas, Steam, and Water (all Sizes), Welded or Riveted. TANKS, HYDRAULIC MAINS, RETORT-LIDS, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 376, last week's issue.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

STEADY Man wants job as Stoker. Used to Engine and Exhauster, and Scoop or Shovel Charging. Age 29. Good References.
Address W. BUDD, 68, Morley Road, Barking, ESSEX.

WANTED, by a capable and trustworthy man, a Situation as MANAGER of Gas-Works, making 2 to 4 millions.
Apply care of PHILIP THOMAS, Gas-Works, Wellington, SOMERSET.

GENTLEMAN, with knowledge of DRAWING and Experience in TRAVELLING and general routine of Gas Engineer's Office, is open to Engagement. Has good connection with Gas Companies, and no objection to go abroad.
Address No. 2786, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Manager in a Medium-sized Gas-Works. Practically Conversant with every detail of the work to be performed, and the duties required to be discharged. Highest References and Testimonials.
Address No. 2807, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RE-ENGAGEMENT wanted by WORKING MANAGER of Small Gas-Works. Used to Engine and Exhauster, accustomed to Main and Service laying, Meter fixing, and taking Indices. Ten Years' Experience. Good References. Abstainer. Married.
Address No. 2809, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement, see Feb. 2, p. 258.]

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
Telegraphic Address: "Sadler, Middlesbrough."

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

SULPHATE OF AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

CITY OF SHEFFIELD.

RESIDENT ENGINEER FOR LITTLE DON VALLEY NEW WATER-WORKS.

THE City Council of Sheffield on the 9th of December, 1896, passed the following Resolution in connection with the construction of a Reservoir and Works in the Langsett Valley:—

"The Work to be designed and constructed under the charge and direction of an experienced Civil Engineer (to be called 'the Engineer'), who shall reside in the Little Don Valley, or at Sheffield, and devote the whole of his time to his duties under the Corporation, and who shall have daily personal charge of the Work in the Langsett Valley, and be responsible for it throughout, and shall do all special work in connection therewith, which the Water Committee may desire; the Staff of Assistants, Inspectors, Draughtsmen, Clerks, and others being provided by the Corporation, and under the direction of the Engineer."

"The Engineer shall consult with the 'Consulting Engineer' with regard to all Plans and Designs, and at every step during the progress of the Works, but without thereby lessening his own absolute responsibility; and he shall report direct to the Water Committee, from whom alone he will take directions."

The engagement to be until the completion of the Langsett Reservoir, subject to Twelve Months' Notice.

Applications are accordingly requested from competent ENGINEERS; it being indispensable that Candidates for the appointment should have had considerable experience in Designing and Constructing Impounding Reservoirs.

Each application must furnish at least two References, and contain *copies* of Testimonials (which cannot be returned, and which, preferably, should be printed); the Water Committee having the right to call for production of the originals.

The application must state Age, Experience, present Position, *Salary required*, when at liberty, and general state of Health.

The Engineer's Services are sought at present for the construction of the first Reservoir authorized to be made under the Sheffield Corporation Water Act, 1896, to be called the Langsett Reservoir, which will be one of great magnitude.

Another large Reservoir is authorized by the Act, which is intended to be constructed after the completion of the Langsett Reservoir; and in an adjoining Valley—that of the River Ewden—the Corporation have power, and intend afterwards, to construct two other large Reservoirs.

Personal canvassing will be a disqualification.

Communications to be sent to me not later than the 1st of March, 1897, marked on the outside "Langsett Engineer."

HERBERT BRAMLEY,
Town Clerk.

Town Hall, Sheffield,
Feb. 17, 1897.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality.
Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c.
CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.
Before placing Orders, please write for Estimate.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE. Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

ECONOMY IN PURIFICATION.

INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
And J. EVERY & SON, Phœnix Iron-Works, LEWES.

In Paper Covers, Post Free 2s.

STEPHEN CARPENTER, late of the Bow Common Gas-Works, on the PURIFICATION OF COAL GAS BY LIME, &c., and the Method of Working Lime Purifiers so that the Lime may be used a second time, with a Description of a short Method of Working the Sulphur Test.
S. CARPENTER, "Ryde," Woodhouse Grove, East Ham, ESSEX; or of H. W. CARPENTER, 3, Bedford Villas, Carshalton, SURREY.

TO GAS AND WATER OFFICIALS.

SPECIAL and favourable Terms for CYCLES are offered. The very best "up-to-date" Cycle at a reasonable cost. Splendid value for money. Catalogue post free.
MELROSE CYCLE COMPANY, COVENTRY.

WANTED, a steady Reliable Man as leading STOKER. Good Wages.
Apply to Mr. G. HELPS, Gas-Works, HINCKLEY.

WANTED, for an established Gas Company in North Brazil, a FOREMAN of Works. He must have had experience of the construction and working of Regenerative Furnaces, as well as be a practical Retort Setter.
Engagement Three Years. Free passage Out and Home.
Apply, by letter only, stating Salary required, with *copies only* of Three recent Testimonials, to No. 2806, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RUTHIN WATER COMPANY.

WANTED, for a limited period, a Person to EXAMINE and REPAIR the MAINS and SERVICES in the Town; also conversant with the working of Deacon's Waste-Detecting Meter.
Applications, stating Wages required, with References and Testimonials as to ability, to be sent in to me on or before the 26th inst.
DAVID JONES,
Secretary.
Ruthin, Feb. 9, 1897.

GAS TAR and Ammoniacal Liquor Wanted.
Apply to JOSIAH HARDMAN, Milton, STAFFS.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating Price per ton and quantity, No. 2772, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good second-hand Cornish BOILER (size about 18 ft. to 20 ft. long), with all Fittings ready for working.
Offers f.o.r., with full Particulars of Dimensions, make, fittings, and reason why displaced, to be sent to No. 2808, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A Bray's 300-Candle Power LANTERN and BURNERS complete. In good condition.
Offers to Mr. ROBERT HUNTER, Gas-Works, Rcodee, CHESTER.

FOR SALE—Twelve 16-inch Round MOUTHPIECES, with Cross-Bars and Lids complete.
Apply to WM. SEVERS, Engineer and Manager, Gas-Works, Wilms'ow, MANCHESTER.

FOR DISPOSAL—Two Station Gas-METERS, one 10,000 feet Capacity, by W. Parkinson and Co., the other 8000 feet capacity, by J. & J. Braddock. Both are in excellent condition; the latter practically new.
Offers to No. 2798, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also COMPLETE WORKS equal to 7000, 20,000, 60,000 cubic feet per diem. **Inquire and compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

FOR SALE--Framing and Columns for GASHOLDER, 50 ft. by 18 ft.:—
Twelve Main Bars, 3 in. by 3 in. by ⅜ in. T-iron.
48 Secondary Bars, 2 in. by 2 in. by ¼ in. L-iron.
Top Curb . . . 3½ in. by 3½ in. by ⅜ in. „
Bottom Curb . . 4 in. by 4 in. by $\frac{7}{16}$ in. „
Six Vertical Stays, 3 in. by 3 in. by ⅜ in. T-iron.
Six Tension Rods, 1¼ in.
Centre Pipe and Cup.
Six Cast-Iron Columns, 12 in. at base, 10 in. at top.
Six Wrought-Iron Girders.
Six Balance Weights and Chains.
Apply to the GAS-WORKS, UTTOXETER.

TENDERS wanted for the Excavating and LAYING of 1200 Yards of 12-inch Turned and Bored GAS-MAINS.
State Price, &c., to WM. SEVERS, Engineer and Manager, Gas-Works, Wilmslow, MANCHESTER.

TENDERS are invited for Lighting the City of S. PAULO (BRAZIL) BY GAS, and must be sent under sealed covers, marked "Illuminaçao a Gaz da Cidade de S. Paulo," to the Secretaria da Agricultura, Commercio, e Obras Publicas (Department of Agriculture, Commerce, and Public Works), in time to reach the said Department not later than Three o'clock p.m., on April 30, 1897.
Particulars may be had on application, by letter, to the BRAZILIAN LEGATION, LONDON; or to the BRAZILIAN CONSULATES in LONDON, LIVERPOOL, or GLASGOW.

THE Urban District Council of Atherton invite TENDERS for the supply, during the Twelve Months ending March 31, 1898, of 5000 Tons of GAS COAL.
Forms of Tender and other Information may be obtained on application to the undersigned, to whom the tenders, endorsed "Gas Coal," should be delivered not later than Wednesday, March 3.

D. SCHOFIELD,
Clerk.

Atherton, Feb. 13, 1897.

BOROUGH OF CLITHEROE.

THE Gas Committee invite Tenders for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Gas-Works for One Year from the 25th of March next, delivered into Purchaser's Tank-Trucks at the Gas-Works Siding.
Sealed tenders, endorsed "Tender for Tar" or "Liquor," or both, as the case may be, to be addressed to the Chairman of the Gas Committee on or before the 27th inst.

ROBT. BARRETT,
Manager.

Gas-Works, Clitheroe,
Feb. 19, 1897.

TENDERS FOR TAR.

THE Directors of the Exeter Gaslight and Coke Company invite TENDERS for their surplus TAR, for One Year from Lady-day next.
Delivery on Company's Works filled into Purchaser's Tanks.
Sealed tenders, endorsed "Tender for Tar," will be received by the undersigned on or before Monday, the 22nd day of March next; but the Directors do not bind themselves to accept the highest or any tender.

By order,
W. A. PADFIELD,
Engineer and Secretary.

Gas Offices: 248, High Street,
Exeter, Feb. 16, 1897.

ROTHWELL GASLIGHT COMPANY.

TENDERS FOR AMMONIACAL LIQUOR.

THE Directors of the above Company are prepared to receive TENDERS for LIQUOR to be produced at their Works for One Year ending the 30th of April, 1898.
Quantity about 250 Tons.
Tenders to state price per ton for 4° to 8° Twaddel.
Delivery may be taken at the Works, or into Contractor's Tank-Waggons, at Rothwell Station.
Tenders, endorsed, to be delivered not later than Wednesday, the 10th of March next.
The Directors do not bind themselves to accept the highest or any tender.

By order,
THOS. WORMALD,
Secretary.

Gas Office, Rothwell, Leeds.

THE Clevedon Gas Company invite TENDERS for the supply of 20 Tons of NEW OXIDE, f.o.r. Clevedon, and for about 30 Tons of SPENT OXIDE.
Tenders to be sent in, under cover marked "Tender for Oxide," by the 4th day of March next.

By order,
S. DAWES.

Gas-Works, Clevedon,
Feb. 16, 1897.

RADCLIFFE AND PILKINGTON GAS COMPANY.

TENDERS FOR PIPES.

THE Directors of this Company invite TENDERS for the supply of 1440 yards of 10-inch CAST-IRON GAS-MAINS.
Further Particulars may be obtained from the undersigned, by whom tenders will be received until Tuesday, the 2nd day of March.

JAMES BRADDOCK,
Manager and Secretary.

Gas-Works, Radcliffe,
Feb. 18, 1897.

TENDERS FOR GAS COAL.

THE Corporation Gas Committee of Stoke-upon-Trent, invite TENDERS for the supply of GAS COAL.
Specification and Form of Tender may be obtained on application to the undersigned, or at the Gas Offices.
Tenders to be sent in not later than Twelve o'clock noon, the 11th of March, 1897, addressed to His Worship the Mayor, Stoke-upon-Trent, and endorsed "Tender for Gas Coal."

WM. PRINCE,
Engineer and Manager.

Gas-Works, Stoke-upon-Trent.

CITY OF MANCHESTER.

TENDERS FOR CAST-IRON PIPES.

THE Gas Committee are prepared to receive, not later than Ten a.m. on Friday, the 26th inst., TENDERS for the supply of about 1400 Tons of CAST-IRON PIPES of 18 inches to 36 inches diameter.
Specifications and Forms of Tender may be obtained on application (in writing only) to Mr. Charles Nickson, Superintendent, Gas Department, Town Hall, Manchester.

By order,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
Feb. 17, 1897.

BOROUGH OF BRIGHOUSE.

TO ENGINEERS.

THE Gas Committee of the Brighouse Corporation are prepared to receive TENDERS for the supply and delivery, and fixing at the Mill Lane Gas-Works, of—
Two STEAM-BOILERS,
ROTARY GAS EXHAUSTERS and ENGINE combined,
And a quantity of 12-inch, 9-inch, and 6-inch CAST-IRON SOCKET PIPES.
Further Particulars and Form of Tender can be obtained on application to the undersigned.
Sealed tenders are to be sent in on or before Tuesday, the 2nd of March, 1897, addressed to the Town Clerk, Public Offices, Brighouse, endorsed on the outside "Tender for Boilers," "Exhausters," or "Pipes," as the case may be.
The lowest or any tender not necessarily accepted.

JAMES PARKINSON,
Engineer.

Public Offices, Brighouse,
Feb. 17, 1897.

BOROUGH OF BRIGHOUSE.

THE Town Council are prepared to receive TENDERS for the supply of the following STORES—viz., FIRE-CLAY GOODS, IRONMONGERY, OIL PAINTS, &c., STEEL GOODS, New GAS-METERS, BRASS MAIN COCKS, WROUGHT-IRON TUBES and FITTINGS, WROUGHT-IRON GOODS, and BRUSHES—required by the Gas Committee during the Year ending March 31, 1898.
Specification and Form of Tender can be obtained on application at the Gas Engineer's Office, Mill Lane Works, Brighouse.
Sealed tenders are to be sent in on or before Tuesday, the 2nd day of March, 1897, addressed to the Town Clerk, Public Offices, Brighouse.
The lowest or any tender not necessarily accepted.

By order,
JAMES PARKINSON,
Town Clerk.

Public Offices, Brighouse,
Feb. 16, 1897.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

TO THE PROPRIETORS.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Company's Offices, No. 5, Great Winchester Street, London, on Friday, the 12th of March, 1897, at Two o'clock in the afternoon precisely, to receive the Report of the Directors and the Accounts of the Company for the Half Year ended the 31st of December, 1896, to declare Dividends, to elect two Directors, to appoint a Special Auditor, and for other purposes.
The TRANSFER BOOKS of the Company WILL BE CLOSED from the 27th of February to the 12th of March, both days inclusive.

By order,
ERNEST L. BURTON,
Secretary.

5, Great Winchester Street,
London, E.C., Feb. 20, 1897.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at the Company's Offices, Willoughby Lane, Tottenham, on Saturday, the 27th day of February inst., at Half-past Three o'clock in the afternoon precisely, to receive the Report of the Directors, the Statement of Accounts for the Half Year ended the 31st day of December, 1896, to declare a Dividend, and transact such other Business as the Act of Parliament directs.
The TRANSFER BOOKS WILL BE CLOSED from Saturday, the 13th inst., until Monday, the 1st day of March next.

By order of the Board of Directors,
JAMES RANDALL, Secretary.

Offices of the Company:
Willoughby Lane, Tottenham,
Feb. 5, 1897.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.
He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.
Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.
Offices: 18, FINSBURY CIRCUS, E.C.

By Order of the Directors of the
LOWESTOFT WATER, GAS, AND MARKET COMPANY.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, London, E.C., on Tuesday, the 2nd of March, at Two o'clock.
£5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.
in the above Undertaking, offering to Trustees and others an Investment of the highest class.
Particulars of the SECRETARY, LOWESTOFT; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Administrator of H. F. Palmer, Esq. deceased, and other Owners.

GAS AND WATER STOCKS AND SHARES IN THE FOLLOWING COMPANIES.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.
£500 "B" Stock.
WEST HAM GAS COMPANY.
146 £5 Shares and 113 £10 Shares.
BARNET DISTRICT GAS AND WATER COMPANY
£1010 "A" Capital Stock.
SOUTH-WEST SUBURBAN WATER COMPANY.
91 £10 Shares.
ILFORD GASLIGHT AND COKE COMPANY, LTD.
85 £5 "B" Shares.
TUNBRIDGE WELLS GAS COMPANY.
£150 Consolidated Stock.
CRAYS GAS COMPANY.
25 £10 Shares.
WEST KENT GAS COMPANY.
25 £10 fully-paid Shares and 60 £10 Shares (£4 paid).

MR. ALFRED RICHARDS will Sell the above BY AUCTION at the Mart, E.C., on Tuesday, the 2nd of March, at Two o'clock.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

(INCORPORATED BY ACT OF PARLIAMENT, 1859.)

SALE OF £15,000 STOCK.

MR. ALFRED RICHARDS is instructed to SELL BY AUCTION at the Mart, Tokenhouse Yard, E.C., on Tuesday, the 9th of March, 1897, at Two o'clock, in Lots of £100 and £50 each,
£15,000 OF "C" STOCK,
ranking for a Standard Dividend of 7 per cent., subject to the Sliding-Scale (the last Dividend on similar Stock having been at the rate of 8½ per cent.), and issued pursuant to the Company's Act of 1882.
Particulars may be obtained at the COMPANY'S OFFICES, Willoughby Lane, TOTTENHAM; of Messrs. MERRIMAN, PIKE, and MERRIMAN, Solicitors, 25, Austin Friars, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C., and 816, High Road, TOTTENHAM.

FYLDE WATER-WORKS COMPANY.

TRUSTEE INVESTMENT STOCK.

TO be Sold by Auction, by Messrs. T. DEWHURST AND SON, at their Sale-Rooms, 122, Fishergate, Preston, at Three p.m. on Thursday, March 18, 1897,
£16,000
FOUR PER CENT. PREFERENCE STOCK
of and in the Fylde Water-Works Company, in pursuance and under the Provisions of the Fylde Water Act, 1891.
The Stock will be sold in lots of £100 each.
The Purchase is not confined to Stockholders in the Company.
£10 per cent. deposit on the nominal amount of the Stock purchased, together with the whole of the Premium, will be required to be paid at the time of sale; and the Balance of the Purchase Money will be payable on or before the 17th of April, 1897. The Stock will rank for Dividend from the date of payment of such Balance.
Under the Trust Investment Act, 1889, Trustees and others can invest in this Stock.
The Stock purchased will be issued free of all charge.
For further Particulars apply to William J. Dickson, Esq., Solicitor, Kirkham; or to

C. ARTHUR, Secretary.

Fylde Water-Works Office,
Cedar Street, Blackpool,
Feb. 10, 1897.

CHESTER UNITED GAS COMPANY.

SALE OF £4000 ORDINARY "C" STOCK,
BEARING A MAXIMUM DIVIDEND OF 7 PER CENT.,
PURSUANT TO ACT OF PARLIAMENT, 43 AND 44 VIC., CAP. 9
(CHESTER GAS ACT, 1880).

THE Directors of the Chester United Gas Company GIVE NOTICE that £4000 ORDINARY "C" STOCK of and in the Chester United Gas Company, bearing a Maximum Dividend of 7 per cent., or so much of that amount as may be sufficient to realize the balance of £50,000 Additional Capital, authorized to be raised under the Powers of the Chester Gas Act, 1880, will be offered for

SALE BY AUCTION
BY
MESSRS. BRANCH AND LEETE,

on Tuesday, the 23rd day of March, 1897, at One o'clock in the afternoon precisely, at the Law Association Rooms, Cook Street, in Liverpool, subject to the Conditions of Sale, which will be then produced.

The Stock will be offered in Lots of the nominal amount of £100 each, and will be issued to each purchaser as paid-up Stock after the full payment of the Purchase Money.

For further Particulars, apply to the undersigned, or to the Auctioneers, Messrs. Branch and Leete, Hanover Street, Liverpool.

By order,
JAMES PYE,
Secretary.

Gas Offices, Cuppin Street,
Chester, Feb. 18, 1897.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

COKE-BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,
165, QUEEN VICTORIA STREET, E.C.,
And at STROUD, GLOUCESTERSHIRE.

Lanemark Coal Co.,
LIMITED.
LANEMARK CANNEL
AND GAS COALS.
Quotations and Analysis on Application to
LANEMARK COLLIERY,
NEW CUMNOCK, N.B.
Shipping Ports: All the principal Scotch Ports.

SPECIAL TERMS OFFERED TO GAS AND WATER OFFICIALS.

"ROYAL EAGLE" CYCLES
(DUNLOP TYRES)
ARE
BUILT UNDER EXPERIENCED SUPERVISION.
RENOWNED FOR EXCELLENT DESIGN AND FINISH.
— PATRONIZED BY ROYALTY. —
Send at once for our Catalogue Album.
HOTCHKISS, MAYO, & MEEK, COVENTRY.

[*Please mention "JOURNAL" when applying for Particulars.*]

LONDON OFFICE
60, QUEEN VICTORIA ST. E.C.
TELEGRAPHIC ADDRESSES
"DRAKESON HALIFAX."
"ECLAIRAGE LONDON."
TELEPHONE Nº 43.
"HALIFAX EXCHANGE"
GAS ENGINEERS.
CONTRACTORS.
IRONFOUNDERS.
RETORT SETTERS.
FURNACE BUILDERS.
ETC. ETC.
JONAS DRAKE & SON
SOLE AGENTS FOR
HISLOP'S
PATENT REGENERATIVE FURNACES
— FOR —
ENGLAND, WALES & ABROAD.
RETORT BENCHES ERECTED COMPLETE
WITH OR WITHOUT SPECIAL FURNACES.
RESULTS GUARANTEED.
OVENDEN HALIFAX
Designs and Estimates on Application.
GASEOUS FIRING A SPECIALTY.

PUBLICATIONS

ISSUED BY

WALTER KING,

11, BOLT COURT, FLEET STREET, LONDON, E.C.

ALL PARCELS SENT CARRIAGE FREE.

Now Ready, Price 5s. 6d., Post Free.

— FOURTEENTH YEAR —

THE

COMPLETE REPORTS

OF PROCEEDINGS OF THE

ASSOCIATIONS

OF

GAS ENGINEERS & MANAGERS

OF THE UNITED KINGDOM

FOR 1896.

The Thirteen previous Volumes (1883-95) are still on sale, Price 3s. each, Post free.

Price 7s. 6d., Demy 4to., Limp Cloth.

THE FLOW OF GASES

AND

PROPORTIONING GAS-MAINS.

FOUR DIAGRAMS

(with Explanatory Pamphlet),

Invented by

F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E.

THE GUIDE-FRAMING OF GASHOLDERS AND OTHER PAPERS, CHIEFLY RELATING TO STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS. — By F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E. Bevelled cloth. Price 6/-.

GASHOLDERS WITH OR WITHOUT GUIDE-FRAMING.—A Discussion between E. Lloyd Pease and F. Southwell Cripps. To which is added a Synopsis of all the Literature (English and Foreign) on Reducing or Abolishing the Guide-Framing of Gasholders, also the principal Literature on Gasholder Construction generally, compiled to March, 1893; with a List of all the English and Foreign Periodicals connected with the Gas Industry.—By F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E. In Paper Covers. Price 1/-.

THE CHEMISTRY OF ILLUMINATING GAS.—By NORTON H. HUMPHRYS, Assoc.M.Inst.C.E., F.C.S. Price, bound in cloth, 6/-.

THE VALUATION OF GAS-WORKS FOR ASSESSMENT. — By THOMAS NEWBIGGING, M.Inst.C.E. Price 3/6 (76 pages, demy 8vo., limp cloth).

THE SCIENCE AND PRACTICE OF LIGHTING as applied to Streets, Open Spaces, and Interiors. — By W. H. Y. WEBBER. Price 3/6 (Demy 8vo. cloth).

TABLES OF VALUES, DISCOUNTS, DIVIDENDS, AND WEIGHTS AND MEASURES, FOR USE IN GAS OFFICES.—Arranged by THOMAS NEWBIGGING, M.Inst.C.E. Price 2/-.

ANALYSES OF SCOTCH COALS, CANNEL, SPLINT, SHALE, &c., USED IN THE MANUFACTURE OF GAS.—By (the late) Dr. WILLIAM WALLACE, of Glasgow. Price, in stiff cover, fcap. folio, oblong, 1/-.

ANALYSIS OF THE ACCOUNTS OF THE METROPOLITAN WATER COMPANIES.—Issued Annually, as compiled and arranged by ALFRED LASS, F.C.A. Sixteenth year, 1895-96, price 15/-. Previous Volumes still on sale.

THE COMPOSITION AND USE OF GAS LIME IN AGRICULTURE.—By (the late) Dr. A. VOELCKER, Professor of Chemistry to the Royal Agricultural Society of England. A 4-pp. leaflet for distribution among farmers and others. Price 5/- per 100.

CONSPIRACY AND PROTECTION OF PROPERTY ACT.—It is required, under a Penalty of FIVE POUNDS, that a printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat. Printed copies of this section, in large type, on broad sheets, price 2/- per dozen, or 10/6 per 100. The Act extends to Scotland and Ireland.

ORDERS FOR OTHER TECHNICAL PUBLICATIONS WILL BE EXECUTED AT PUBLISHERS' PRICES.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, $16\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) $13\frac{3}{4}$ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . $13\frac{1}{2}$ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor $94\frac{1}{2}$ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

NEWCASTLE-UPON-TYNE.

THE "COOMBE" DRAUGHT SCREEN

FOR INCANDESCENT BURNERS.

For Illustration and Statement of Advantages to be gained by its use, see "JOURNAL," Feb. 2, p. 214.

ALFRED ARCULUS & CO., Glass Manufacturers,

BIRMINGHAM.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For Prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,

FITTER.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, $1\frac{1}{2}$ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

THE SILICA FIRE-BRICK

COMPANY,

OUGHTIBRIDGE, near SHEFFIELD

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,

for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

JOHN BROWN & CO., LTD., SHEFFIELD.

Proprietors of

ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

VERY FREE FROM IMPURITIES.

TELEGRAMS: "ATLAS, SHEFFIELD."

HANNA, DONALD, & WILSON,

(Established 1851),

GAS ENGINEERS & CONTRACTORS,

Abercorn Foundry and Abbey Works,

PAISLEY, N.B.,

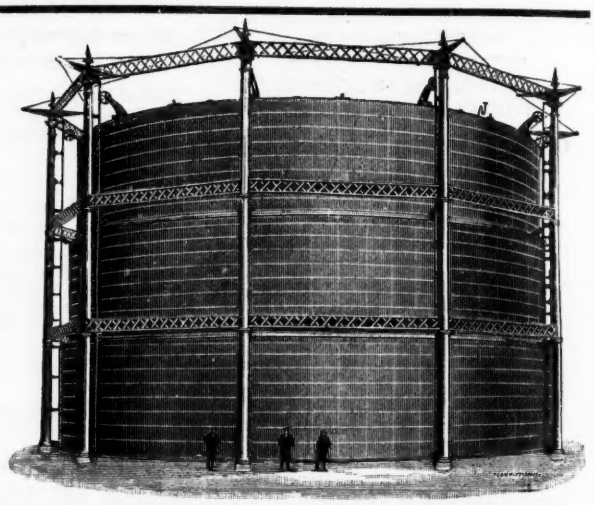
MAKERS OF

Gasholders and Gas Plant

OF EVERY DESCRIPTION.

Sole Agents for Scotland for the Automatic Coal-Gas Retort (Inclined System) Company, Limited.

Telegraphic Address: "Donald, Paisley."

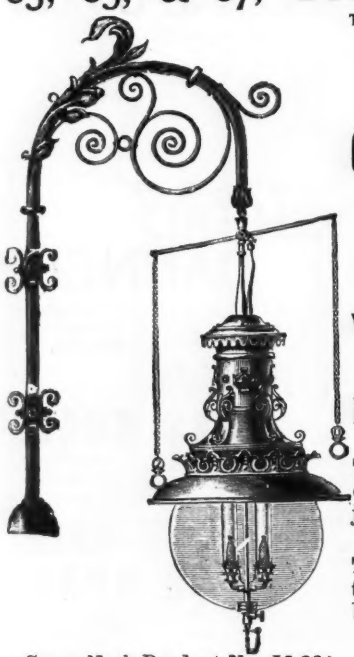


FALK, STADELMANN, & CO., LD.,

VERITAS LAMP WORKS,

83, 85, & 87, FARRINGDON ROAD, LONDON, E.C.

Telegraphic Address: "Lamps, London." Telephone No. 6707.



Swan Neck Pendant **No. 42,281** with Lantern **No. 42,271.**

THE "VERITAS" GAS ARC LANTERNS

(PROTECTED BY ROYAL LETTERS PATENT)

SPECIALLY CONSTRUCTED FOR THE

Incandescent System of Gas Lighting.

Wind, Rain, and Dust Proof.

Enamelled Steel throughout.

Made for One, Two, Three, and Five Lights.

The undisputed great advantages of the **Incandescent System of Gas Lighting** are frequently prejudiced by atmospheric influences upon the Mantles or by sudden gusts of wind.

These deficiencies have been entirely overcome by the construction of our "VERITAS" GAS ARC LANTERN, which differs from others, and which we are confident is the best yet offered.

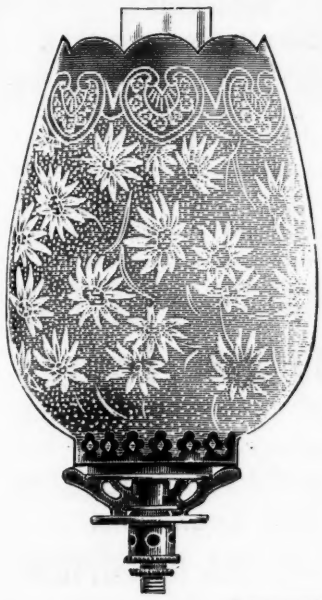
Each Lantern complete; nothing to get out of order; and no skill is required in fixing.

No. 42,265.

Managers of Gas Companies will do well to apply for Descriptive Catalogue GRATIS.

(Wholesale only.)

THE 'SUNLIGHT' INCANDESCENT GAS-BURNER.



COMBINES HIGH ILLUMINATING POWER AND GREAT ECONOMY OF GAS, WITH A SOFT PLEASANT LIGHT.

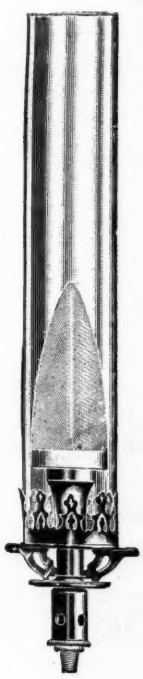
THE MANTLES ARE THE STRONGEST IN THE TRADE.

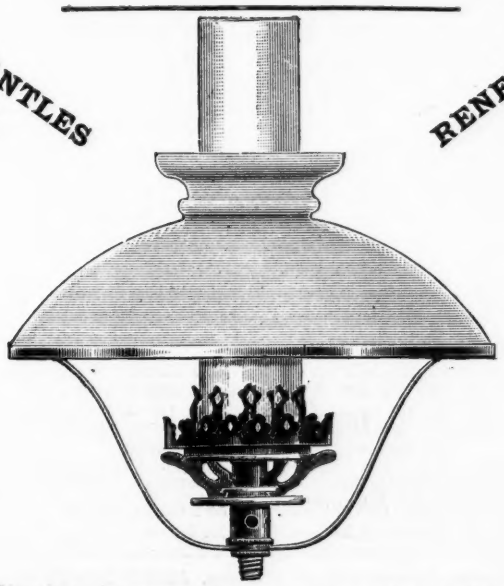
THE NEAREST APPROACH TO SUNLIGHT.

THE IDEAL LIGHT FOR DOMESTIC USE.

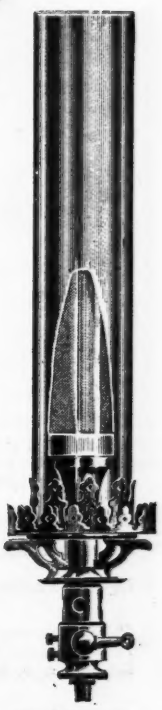
Price from 5/3 complete.

RENEWAL MANTLES 9d. EACH.





RENEWAL MANTLES 9d. EACH.



"COSMO" BURNER COMPLETE, as shown, 12-inch Shade, 7/9 each.

No. 5 Burner.

Price List and Terms on Application.

No. 3 Burner, with Bye-Pass.

THE NEW INCANDESCENT SUNLIGHT PATENT GAS LIGHTING COMPANY, LIMITED,

33 & 34, SHOE LANE, LONDON, E.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 84, OLD BROAD ST., E.C.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

UNEQUALLED.

Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

EVESON FOR CANNEL

TELEGRAMS:
"EVESON, BIRMINGHAM."

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

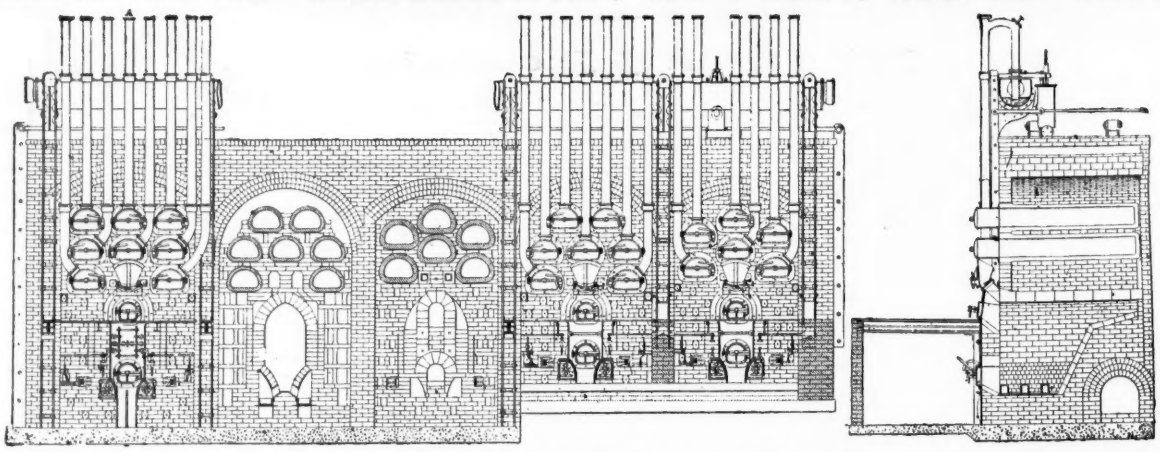
LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Full Particulars may be had on application to the Patentee's Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, 5, Stuart Street, Shawlands, Glasgow, Agent for Scotland and Ireland; and to the Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.
The Patentee's SELF-SEALING CAPS FOR THE TOP OF ASCENSION-PIPES, and his "SPECIAL" FLUE PORT BOXES, are most important additions to his Carbonizing Plant.

SPENT LIMES NO LONGER WASTE PRODUCTS.
Under G. R. HISLOP'S Patents, all Spent Limes are effectively recovered at from one-third to one-half the cost of New Lime.
Further Information and Pamphlets from Principal Agent.

EXCHANGE TELEPHONE: NO. 1756 BANK.

J. & H. ROBUS,

TELEGRAPHIC ADDRESS "ROBUSTNESS, LONDON."

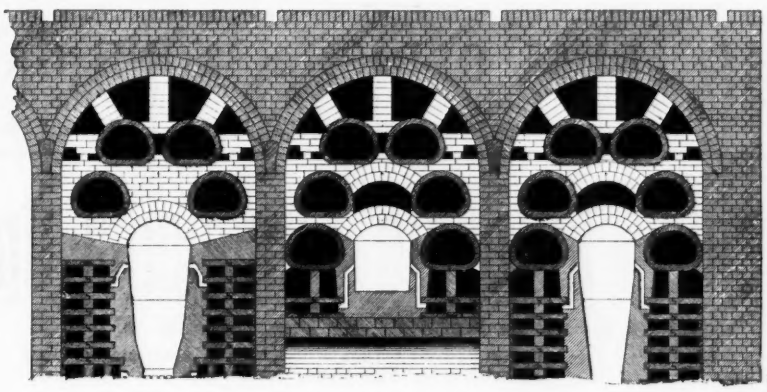
ENGINEERS & CONTRACTORS,

20, BUCKLERSBURY, LONDON, E.C.

Complete Erection or otherwise.

Gasholders, Tanks, and Reservoirs of all sizes.

Gas and Water Main Laying a Speciality.



Retort Setting a "Speciality." Inclined or Horizontal Settings (with or without Regenerative or Generative Furnaces) of the most approved and Economical Designs.

ESTIMATES SUBMITTED FOR

Gas and Water Work of Every Description.

Contractors to H.M. Government.

See Illustrated Advertisement, in last week's "JOURNAL" (p. 331).

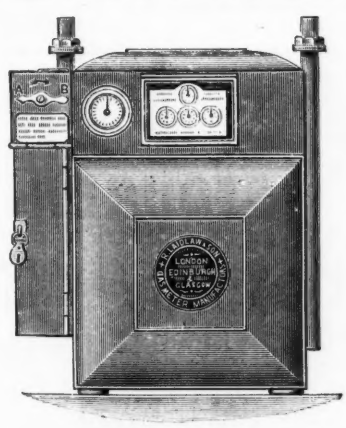
R. LAIDLAW & SON

GAS & WATER ENGINEERS.

MANUFACTURERS OF WET & DRY GAS-METERS,

SIEMENS WATER-METERS,

PREPAYMENT GAS-METERS.



—DRY METER.—

—WET METER.—

EDINBURGH: SIMON SQUARE WORKS. | **GLASGOW:** ALLIANCE FOUNDRY. | **LONDON:** 6, LITTLE BUSH LANE.

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

ADDRESS CHIEF OFFICES:

Temple Buildings, 50, New Street, Birmingham.

HARPER & MOORES,

STOURBRIDGE.

MANUFACTURERS OF

BEST FIRE-BRICKS, GAS-RETORTS,

LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.

Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.

ESTABLISHED 1836.

GAS COAL.

BEST

REAL OLD SILKSTONE GAS COAL,

Address THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

LATEST

Improvements in Sulphate of Ammonia Apparatus

COLSON'S PATENT)

EXTRACT FROM ENGINEER'S REPORT: "I can now obtain **60** Tons of Sulphate of Ammonia per week with 'Colson's' Still, using ONE Boiler, whereas, with my former continuous plant, TWO Boilers were required to produce **40** Tons per week."

EXTRACT FROM LETTER: "As regards the consumption of Lime, I may say that we work with **40** per cent. LESS than on the old system. Of the principle and workmanship of the Stills, I can speak very highly. When once working, we find them very silent, automatic, and requiring very little attention. As for the cleaning out of the Stills, we find they only require doing so once in Six Months; and this can be accomplished in **24** HOURS AGAINST **3** OR **4** DAYS with the old style of upright Stills." WILFRID WYLD, Bradford Corporation Chemical Works.

For Prices and Particulars, apply to the Sole Makers—

ASHMORE, BENSON, PEASE, & CO., Limited,

Gas-Works Contractors, STOCKTON-ON-TEES.

D. HULETT & CO., LTD.

55 & 56, High Holborn, London.

GAS SERVICE CLEANSERS.

LAMP TORCHES.

DRY GAS-METER MAKERS.

WROUGHT-IRON TUBES & FITTINGS.

STREET LAMPS & POSTS.

PRICE LISTS ON APPLICATION.

MOBBERLEY & PERRY

STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c. &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

Contractors for the erection of Retort-Benches complete.

London Agents:

BALE & HARDY,

Gas Engineers and Contractors,

BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

ALEX. C. HUMPHREYS, M.Inst.C.E. [A. G. GLASGOW, M.E.

MESSRS. HUMPHREYS & GLASGOW

Have constructed their **EUROPEAN** type of

CARBURETTED WATER-GAS PLANT

At the following Gas-Works:—

Copenhagen	700,000 Cub. Ft.	Preston	1,500,000 Cub. Ft.
Belfast	1,700,000 ,,	Southport	750,000 ,,
Belfast (Second Contract)	4,500,000 ,,	Bath	1,000,000 ,,
Glasgow	300,000 ,,	New York	1,200,000 ,,
Brussels	700,000 ,,	Newburgh, N.Y.	350,000 ,,
Brussels (Second Contract)	700,000 ,,	St. Joseph, Mo.	750,000 ,,
Liverpool	3,500,000 ,,	Winchester	200,000 ,,
Tottenham	750,000 ,,	Hoylake	125,000 ,,
Tottenham (Second Contract)	750,000 ,,	Shanghai	225,000 ,,
Santiago	400,000 ,,	Holyoke, Mass.	600,000 ,,
Swansea	750,000 ,,	Stockport	500,000 ,,
Brighton	1,500,000 ,,		

And have now under Contract:—

Manchester	3,000,000 Cub. Ft.	Brentford	1,100,000 Cub. Ft.
Edinburgh	2,000,000 ,,	Commercial Gas Co., London	850,000 ,,
Stockton-on-Tees	500,000 ,,	Coventry	600,000 ,,
Norwich	1,000,000 ,,	Lea Bridge	350,000 ,,
Guildford	350,000 ,,	Newburgh, N.Y. (Second Contract)	250,000 ,,
Syracuse, N.Y.	850,000 ,,	Bordentown, N.J.	125,000 ,,

In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.

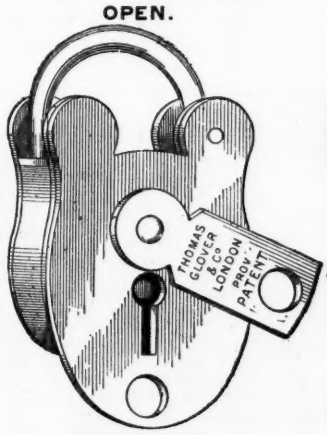
9, Victoria Street, London, S.W. — Telegrams: "EPISTOLARY, LONDON." — *United States Office, 64, Broadway, New York.*

[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;
The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.

OPEN.



THOMAS GLOVER & CO.'S

PATENT

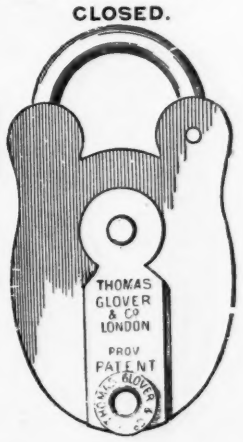
SECURE PADLOCK

Prevents Tampering with the

CASH-BOXES OF PREPAYMENT METERS.

The Padlock is Sealed by means of a Lead Eyelet, which is impressed with Company's private mark. Eyelets easily fixed and removed by Company's Collector.

CLOSED.



Telegraphic Address: "GOTHIC LONDON." Telephone No. 6725.

THOMAS GLOVER & CO., LTD.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

BRISTOL: 62, VICTORIA STREET. *Telegraphic Address: "GOTHIC."*

BIRMINGHAM: 1, OOZELLS STREET. *Telegraphic Address: "GOTHIC."*

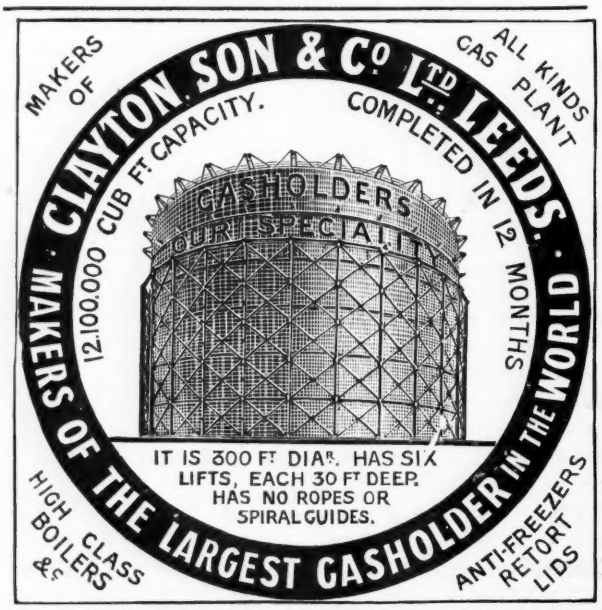
MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address: "GOTHIC."*

STOURBRIDGE
RETORTS AND FIRE-BRICKS.
BEST QUALITY.

KING BROTHERS, STOURBRIDGE.
[See Illustrated Advertisement, Feb. 2, p. 259.]

PETTIGREW'S PATENT
Sulphate of Ammonia Plant
ON THE CONTINUOUS SYSTEM
Is the newest in the Market, and is the outcome of practical experience in Sulphate Making.
Old Systems easily and cheaply converted.
ANY SIZE ERECTED COMPLETE AT HOME OR ABROAD.
Write for Particulars, Testimonials, and References to
GEO. PETTIGREW & Co.,
GAS AND CHEMICAL ENGINEERS,
MIDDLESBROUGH-ON-TEES.

ARROL-FOULIS
Patent Automatic Machinery
FOR
DRAWING AND CHARGING GAS-RETORTS.
Full Particulars may be obtained from the Sole Makers,
SIR WILLIAM ARROL & CO., Limited,
GLASGOW.
[See Illustrated Advertisement, Feb. ?, p. 262.]


MAKERS OF
CLAYTON, SON & Co LTD LEEDS.
ALL KINDS GAS PLANT
12,100,000 CUB Ft. CAPACITY.
COMPLETED IN 12 MONTHS
GASHOLDERS
OUR SPECIALITY
IT IS 300 Ft DIAR. HAS SIX LIFTS, EACH 30 Ft DEEP. HAS NO ROPES OR SPIRAL GUIDES.
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
HIGH CLASS BOILERS &c
ANTI-FREEZERS RETORT LIDS

GIRDERS, ROOFS, & ALL KINDS OF STRUCTURAL IRONWORK.
London Office: 60, QUEEN VICTORIA STREET, E.C.
Telegraphic Addresses: "GAS, LEEDS," "ECLARAGE, LONDON."

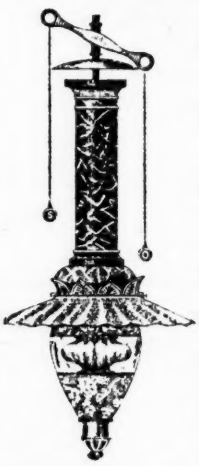
BOWENS' Ltd. Successors,
STOURBRIDGE.
MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
Established 1860.

WILLIAM INGHAM & SONS,
Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS,
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—
1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

The Climax of Regenerative Gas Lighting!!

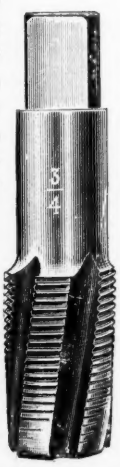


THE
"VERTMARCHE"
A 280-CANDLE POWER PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England.
HENRY GREENE & SONS,
153 & 155, CANNON STREET, LONDON BRIDGE, E.C.
PARTICULARS AND PRICES FREE. AGENTS WANTED.

PATENT TWISTED TAPER
RYMERS & TAPS.

These **Patent Twisted Taper Rymers and Taps** are the best ever made for Gas and Water Service Connections. A true Hole and a correct Thread can be assured. They are easy to work, and will last much longer than straight grooved Taps and Rymers.

THOUSANDS ARE IN DAILY USE.



Also SCREWING-MACHINES, STOCKS and DIES (with Patent Twisted Dies), PIPE-TONGS, and other TOOLS.

Apply for Prices and Particulars to
JOHN RUSCOE,
ALBION WORKS, HYDE, near MANCHESTER.

OXIDE OF IRON.

NATURAL BOG ORE FROM OWN MINES.

Samples and Prices on application.

Wm. H. MÜLLER & CO.,

81, PALMERSTON BUILDINGS, LONDON, E.C.

TRADE MARK: "Compascum." Telegraphic Address: "FERRUM."

JOSEPH CLIFF & SONS,

INCORPORATED IN

THE LEEDS FIRE-CLAY COMPANY, Ltd.

WORTLEY, LEEDS.

LONDON OFFICES & DEPÔTS:

Baltic Wharf, Waterloo Bridge.

WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.

LIVERPOOL:

16, Lightbody Street.

LEEDS:

Queen Street.

MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO

GODDARD, MASSEY, & WARNER,

ENGINEERS,

NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

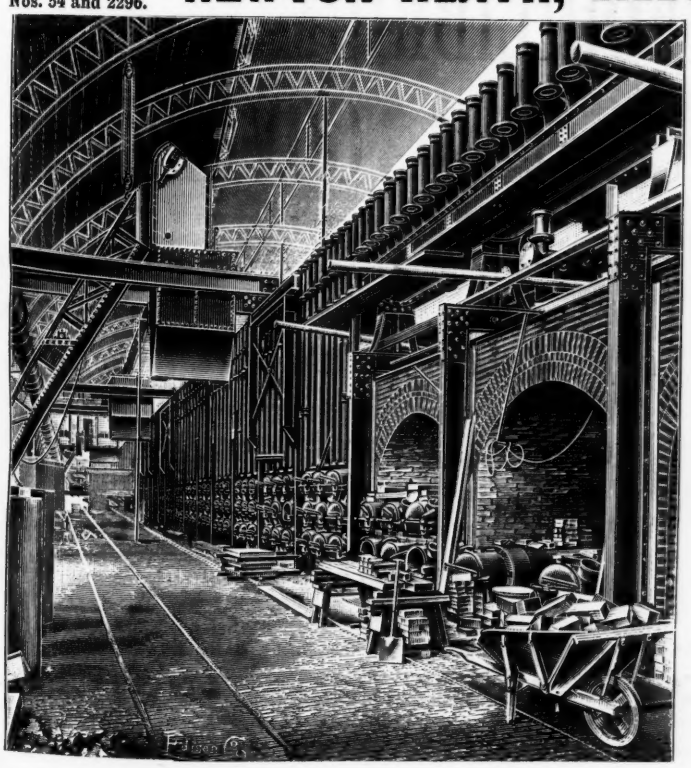
And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

R. & J. DEMPSTER, LTD., GAS PLANT WORKS,

Telegraphic Address: "SCRUBBER, MANCHESTER." National Telephone Nos. 54 and 2296.

NEWTON HEATH, MANCHESTER.



MAKERS AND CONTRACTORS FOR

RETORT BENCHWORK,
SUPERSTRUCTURE,
MOUNTINGS, and
CONSTRUCTIONAL
IRONWORK OF EVERY DESCRIPTION.

LONDON OFFICE:

181, Gresham House, Old Broad St., E.C.

W. PARKINSON & CO.

SQUARE STATION METERS.

All the Meters (which number 14) at the Beckton Station of THE GASLIGHT AND COKE COMPANY have been erected by the above Firm.

PARKINSON'S PATENT EQUILIBRIUM GOVERNORS.

A very large number are now at work; and all Engineers who have adopted them speak in unqualified terms of their great efficiency.

COUNTERBALANCE or AIR VESSEL, as desired.
TWO, FOUR, or SIX COLUMNS and GIRDERS.
WEIGHTS or WATER PRESSURE.

COTTAGE LANE WORKS, CITY ROAD,
LONDON.
Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS,
BIRMINGHAM.
Telegraphic Address: "GAS-METERS."

[See also Advt. p. 396.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square): and published by him at 11, Bolt Court, Fleet Street in the City of London.—Tuesday, Feb. 23, 1897.